RAILROAD GAZETTE

FRIDAY, DECEMBER 26, 1902.

CONTENTS

Railroad Built in 1902.

A careful preliminary estimate made by individual canvass of the railroad companies, and supplemented by our own records, figures furnished by the State Railroad Commissions, and other sources of information, shows that approximately 6,026 miles of new steam railroad have been built within the United States between Jan. 1 and Dec. 31, 1902. The figures are exclusive of second track, sidings and all electric lines. Rebuilt mileage is also excluded except where the work involved such extensive changes in alignment that a new route was established, as in the case of the Southern Pacific between certain points in Nevada.

Railroad building was reported done in 42 States and territories, and Oklahoma leads the list with track laid on 570 miles of new line during the year. Texas comes second with 496 miles, Arkansas is third with 371 miles, and Indian Territory is fourth with 363 miles. Georgia built 336 miles during the year. In addition to these, Illinois, Iowa, Missouri and New Mexico show returns of over 200 miles built; and Alabama, California, Florida, Louisiana, Michigan, Minnesota, Mississippi, Ohio, Pennsylvania, Washington and West Virginia built between 100 and 200 miles. No new steam mileage was reported from Alaska, Delaware, Idaho, Maryland, New Hampshire, New Jersey, Rhode Island or Wyoming.

The tables following show that the current figures are considerably larger than those for any year during the past decade. This new mileage has not been exceeded since 1888.

Mileage Built in the United States.

1893	3,024	1898	3,265
1894	1,760	1899	4,569
1895	1,428	1900	4,894
1896	1,692	1901	5,368
1897	2,109	1902	6,026

Table Showing Mileage Built During 1902, Classified by States.

	No. of Cos. building.	1902.	No. of Cos. building.	1901.
Alabama	11	101.78	7	99.5
Alaska	..	....	..	...
Arizona	4	84.46	5	128.
Arkansas	15	371.	10	162.5
California	11	136.5	8	78.
Colorado	3	55.36	4	90.4
Connecticut	1	4.	..	...
Delaware	..	....	..	...
Florida	7	144.	5	52.5
Georgia	15	336.37	11	212.
Idaho	..	....	2	112.5
Illinois	9	231.9	11	171.9
Indiana	3	79.85	5	172.6
Indian Territory	7	362.95	4	105.
Iowa	7	209.74	8	209.
Kansas	3	58.52	3	35.
Kentucky	2	34.	7	63.
Louisiana	11	146.35	8	104.
Maine	6	85.84	3	14.2
Massachusetts	1	4.	1	7.
Michigan	19	144.23	18	205.5
Minnesota	8	167.32	8	200.
Mississippi	4	131.	8	150.8
Missouri	7	231.27	12	201.3
Montana	3	59.	3	106.
Nebraska	2	73.5	..	...
Nevada	1	95.	1	41.
New Mexico	4	279.6	3	217.7
New York	8	63.18	7	30.9
North Carolina	8	76.8	8	90.2
North Dakota	5	98.12	6	121.
Ohio	9	132.1	7	124.7
Oklahoma	6	570.	5	428.7
Oregon	2	21.	2	27.
Pennsylvania	24	199.84	11	106.6
South Carolina	1	6.	5	58.
South Dakota	8	57.56	4	92.5
Tennessee	6	50.31	9	93.5
Texas	18	495.67	16	537.
Utah	3	81.	1	20.
Virginia	7	54.14	4	29.6
Vermont	1	2.	1	18.
Washington	6	139.17	11	157.
West Virginia	13	140.48	14	182.8
Wisconsin	9	146.5	5	210.3
Wyoming	..	....	2	53.
Total, United States	293	6,026	277	5,368
Canada	13	341.63	..	...
Mexico	11	392.75	..	...

United States.

ALABAMA.

Alabama & Florida (L. & N.)—Extension south from Geneva 3.00
Alabama & Mississippi—Vinegar Bend, Washington County to Mississippi line 7.00
Birmingham & Atlantic—Poor House Junction, Ala., to Poor House, 5 miles; extension from Stanley Junction, 1 mile; total 6.00
Birmingham, Selma & New Orleans (L. & N.)—Thomaston to Myrtlewood 20.80
Campbell Coal & Coke (N. C. & St. L.)—Near Bridgeport, Ala., to State line 8.00
Louisville & Nashville—End of track to Selma 5.00
Lumber line to Attala 2.00
Mobile & Ohio (Warrior Southern)—Not specified 5.00
Sample Lumber Co.—Overbrook to Coosa County line 7.50
Southern—Not specified 32.98
Spring Garden to Frog Mountain 4.50
101.78

ARIZONA.

El Paso & South Western—Line to Douglas, 49 miles; Nac to Naco Junction, 4 miles; total 53.00
Lordsburg & Hachita (Ariz. & N. Mex.)—State line to Hachita 11.00
Santa Fe, Prescott & Phoenix—Poland Junction to Poland, 8 miles; Mayer to Turkey Creek, 12 miles; total 20.00
United Verde & Pacific—Change in line 0.46
84.46

ARKANSAS.

Arkansas Western—Bryan to Heavener 22.00
Bearden & Ouachita River—Mile Post 10 to Mile Post 13 ..... 3.00
Chickasawba—Blytheville to Barfield 10.00
De Queen & Eastern—De Queen to end of track 30.00
El Dorado & Bastrop—State line to El Dorado, Ark. 44.00
Louisiana & Arkansas—Hope to Stamps, Ark. 22.00
Mississippi, Arkansas & Western—Crooked Bayou to Vinson 4.00
Mississippi River, Hamburg & Western—Crossett to Hamburg 12.00
Ozark & Cherokee Central—Lincoln to Tahlequah ... 47.00
Pine Bluff & Western—Doylestown to Sheridan 12.00
Prescott & Northwestern—Arcadia to Gillett, 15 miles; Beiton to Toki, 15 miles; total 30.00
St. Louis & North Arkansas—Harvieson to Gilbert ... 35.00
St. Louis, Memphis & Southeastern—Naylor to Pocahontas 33.00
Tyronza Central (St. L. & S. F.)—Not specified 7.00
White River (Missouri Pacific)—White River Junction to south line of Baxter County 60.00
371.00

CALIFORNIA.

Atchison, Topeka & Santa Fe—Barnwell to Ivanpah. 16.00
Brooking Lumber & Box Co.—Extension to timber lands in San Bernardino County 3.00
California Northwestern—Ukiah to Willits 26.00
El Dorado Lumber Co.—Extension toward Placerville. 5.00
Eureka & Klamath River—End of line to Camp 9 .... 2.50
Lake Tahoe—From end of line 1.00
Los Angeles & Redondo—Redondo to Inglewood, 8 miles; Inglewood to Los Angeles, 9 miles; total .. 17.00
Nevada-California-Oregon (Sierra Valleys)—Clairsville to Mohawk 6.00
Pacific Lumber Co.—Extensions to timber lands 10.00
San Pedro, Los Angeles & Salt Lake—Not specified .. 31.00
Sierra—Jamestown to Angels 19.00
136.50

CONNECTICUT.

Central New England—Tariffville to East Granby 4.00

COLORADO.

Colorado Springs & Cripple Creek District—Extension from Santa Fe junction 1.00
Denver & Rio Grande—Delta to Somerset, 43.10 miles; Yak tunnel to zinc mines, 90 miles; Bessemer to zinc works, 3.36 miles; total 47.36
Rio Grande & Pagosa Springs—Boone to Blanco 7.00
55.36

FLORIDA.

Alabama & Florida (L. & N.)—State line to Graceville 20.00
Brooksville & Hudson—Brooksville towards Hudson, 17 miles; Brooksville to Tooks Lake, 9 miles; total 26.00
Georgia, Florida & Alabama—Extension on Arlington-Cuthbert line 12.00
Lake Hancock & Clermont—Extension from Lake Hancock north towards Clermont 8.00
Suwanee & San Pedro—Extension from end of line to Perry 12.00
United States & West Indies—Durant to Palmetto, 39.5 miles; Terra Cela Junction to Terra Cela, 4.5 miles; Palmetto to Sarasota, 15 miles; total 59.00
Yalaha & Western—Okahumpka to Yalaha 7.00
144.00

GEORGIA.

Atlantic & Birmingham—Fitzgerald to Cordele, 37.2 miles; Cordele to Montezuma, 31.1 miles; total 68.30
Brunswick & Birmingham—Thalman to Nichols 65.00
East & West (S. A. L.)—Sparta to Sandersville 27.00
Fitzgerald, Ockmulgee & Red Bluff—Fitzgerald to Garbutt's Landing 13.70
Georgia, Florida & Alabama—Arlington to Cuthbert, 26.30 miles; Bainbridge towards Tallahassee, 15.62 miles; total 41.92
Georgia Northern—Carlisle, Ga., to Albany 16.00
Hawkinsville & Florida Southern—Extension toward Fitzgerald 3.65
Louisville & Wadley—Old Depot to Main street 6.00
Macon, Dublin & Savannah—Dublin to Vidalia 38.00
Perkins Lumber Co.—Tallapoosa towards Hopewell, Ala. 6.00
Plant (S., F. & W.)—Not specified 14.40
Southern—Not specified 3.00
Tifton & Moultrie—Extension to timber lands owned by Union Lumber Co. 13.80
Tifton, Thomasville & Gulf—Extension from end of line, Sunset to timber 3.00
Wadley & Mount Vernon—Douglas to Broxton, 9 miles; other extensions, not specified, 7.60 miles; total 16.60
336.37

ILLINOIS.

Chicago & Eastern Illinois—Rossville Junction towards Finney, Ind. 5.15
Chicago & North Western.—Nelson to Leonia 85.00
Cincinnati, Indiana & Western—P. & N. R. R., East Springfield, Ill., to Chicago & Alton Ry. junction, Springfield 1.00
Chicago Transfer & Clearing—Industrial tracks 1.50
Chicago Union Transfer—Clearing yards at Elsdon .. 3.25
St. Louis & Ohio Valley (Y. & M. V.)—Reevesville to Golconda 17.00
St. Louis Valley—Extension from near East St. Louis to Gale, Ill. 102.00
Southern Missouri (St. L. & S. F.)—Missouri Junction, Ill., to Mississippi River 6.00
Toluca, Marquette & Northern—Magnolia to Henry .. 10.00
231.90

INDIANA.

Chicago & Eastern Illinois—Extension from State line to Finney 5.85
Cincinnati, Richmond & Muncie—Fulton, Ind., to Peru, 19 miles; Cottage Grove, Ind., to Okeana, Ohio, 18 miles; North Judson, Ind., to Griffith, 41 miles; total 72.00
Muncie Belt—Continuation of belt line tracks 2.00
79.85

INDIAN TERRITORY.

Arkansas, Western—Waldron-Heavener line 10.00
Atchison, Topeka & Santa Fe—Paul's Valley to Canadian River 17.00
Choctaw, Oklahoma & Gulf—Haileyville to Ardmore, 52.30 miles; Haileyville to Wilbarton, 8.85 miles; total 61.15
Fort Smith & Western—McCurtain to Garner, 56 miles; other extensions, not specified, 3 miles; total 59.00
Missouri, Kansas & Texas (Missouri, Kansas & Oklahoma)—Stevens to Dewey, 24.30 miles; Krebs Branch extension, 3.50 miles; total 27.80
Ozark & Cherokee Central—Proctor to Tahlequah 21.00
St. Louis & San Francisco (St. L., S. F. & N. O. R. R.)—Arkinda to Madill 167.00
362.95

IOWA.

Chicago, Burlington & Quincy—Not specified 12.74
Chicago Great Western—Sumner to Hampton 27.00
Chicago, Milwaukee & St. Paul—Muscatine-Kansas City division cut-off, extension west from Muscatine 15.00
Des Moines, Iowa Falls & Northern—Buckeye to Des Moines 65.00
Iowa & St. Louis—Extension from State line to Centerville 11.00
Mason City & Fort Dodge—Fort Dodge to Manning .. 66.00
Newton & Northwestern—Gowrie to Rockwell City, estimated completed, 9½ miles; Fraser to Boone, estimated completed, 3½ miles; total 13.00
209.74

KANSAS.

Fort Scott, Iola & Western (M. K. & T.)—Moran to Iola 15.20
Kansas City, Mexico & Orient—Anthony to Oklahoma line 20.00
Missouri, Kansas & Texas (M. K. & N. W.)—Mineral to Joplin 23.32
58.52

KENTUCKY.

Louisville & Atlantic—Millers Creek to Beattysville. 28.00
Licking River—Cove Branch to Morgan 6.00
34.00

LOUISIANA.

El Dorado & Bastrop—State line to Ouachita River .. 7.60
Leesville East & West—Not specified 4.00
Long Bell System—Extension south of Ringgold, in connection with Sibley, Lake Bistenan & Southern, 12 miles; extension east from Bonami, 6 miles; total 18.00
Louisiana & Arkansas—From a point near Saline Bayou to Winnfield 18.00
Louisiana Western—Mallard Jn. to end of track 7.00
Missouri & Louisiana—Extension west from Carson. 5.00
New Orleans & Northwestern—Bastrop to White 17.00
Shreveport & Red River Valley—Pineville to Mansura 30.75
Southern Pacific—End of track to Gueydan 16.00
Texas Pacific—Bayou Pierre toward Shreveport 18.00
Zimmerman, Leesville & Southwestern—Poe to Edwards 5.00
146.35

MAINE.

Bangor & Aroostook—Van Buren terminus up St. John River 2.00
Fish River—Ashland to Fort Kent 52.00
Madrid—Extension from Madrid Station 6.00
Rumford Falls & Rangeley Lakes—Bemis to Oquossoc, 9 miles; Oquossoc to Toothacker Siding, 2.5 miles; total 11.50
Wiscasset, Waterville & Farmington 14.00
York Harbor & Beach ..... .34
85.84

MASSACHUSETTS.

New York, New Haven & Hartford—North Attleboro to Adamsdale 4.00

MICHIGAN.

Au Sable & Northwestern—Logging branch to forest terminus 5.00
Bay de Noquet Lumber Co.—Nahma to Sturgeon 4.00
Copper Range—Houghton to Calumet and Laurium .. 12.00
Detroit & Charleroi—Not specified 3.00
Detroit & Mackinac—Logging branches 10.50
East Jordan & Southern—South Arm extension along South Arm 5.25
Escanaba & Lake Superior—Logging branch 10.00
Grand Rapids & Indiana—Spurs to mills and timber .. 6.32
Lake Shore & Michigan Southern—Spur lines 2.21
Manistee & Grand Rapids—Not specified 5.00
Manistee & Northeastern—Cedar City to Provement. 11.00
Manistee, Marquette & Northern—Logging branch ... 3.00
Manistique—Germfask to Diller 6.00
Marquette & Southeastern—Lawson to Marquette .. 3.00
Mineral Range—Calumet to Laurium 6.10
Minneapolis, St. Paul & Sault Ste. Marie—End Rapid River Bank to Eben, Mich 21.00
Munising—Stillman to Petrel 1.85
Pere Marquette—Allegan extension 6.00
Wisconsin & Michigan—Faithorn Junction towards Norway 144.23

MINNESOTA.

Chicago & North Western—Evan to Marshall 45.82
Chicago Great Western—Zumbrota to Rochester 27.00
Chicago, Milwaukee & St. Paul—Farmington, Minn., to Montgomery 27.00
Duluth & Northern Minnesota—Lumber branch 16.00
Duluth, Virginia & Rainy Lake—Virginia to Tower Road 22.00
Great Northern—St. Vincent—Emerson, Man., line. 1.50
Itasca Lumber Co.—Jeesie Junction to Baso Lake .. 18.00
Minnesota & International—Extension north from Black Duck 10.00
167.32

MISSISSIPPI.

Alabama & Mississippi—Extension from Alabama State line to Leakesville 7.00
Mobile, Jackson & Kansas City—Merrill to Hattiesburg 46.00
Pearl & Leaf River—Epley to Blountville 31.00
Yazoo & Mississippi Valley—Prichard to Carr, 40 miles; Mattson to Convict Farm, 4 miles; Yazoo City to Belzona, 3 miles; total 47.00
131.00

MISSOURI.

Iowa & St. Louis—Macon, Mo., to State line 72.00
Missouri, Kansas & Texas (Mo., Kan. & N. W.)—State line to Joplin, Mo. 5.53
Missouri Pacific—Cole Junction to Boonville, 41.39 miles; Lake Junction to A., T. & S. F. connection, 7.76 miles; Orongo connection to Granby, 24.29 miles; total 73.44
St. Louis & Gulf—Morehouse to Clarkton, 36 miles; Boynton to Leachville, 3 miles; total 39.00
St. Louis, Kansas City & Colorado—Belle to Gasconade River 9.30
St. Louis, Memphis & Southeastern—Extensions to Naylor 10.00

Southern Missouri & Arkansas (St. L. & S. F.)—Little Rock Landing to Ozark Summit 22.00
231.27

MONTANA.

Elliston & Southern—Elliston to Beatrice mines 4.00
Great Northern—Kalispell Division—Jennings to Gateway 52.00
Northern Pacific—Cinnibar to Gardner 3.00
59.00

NORTH DAKOTA.

Chicago, Milwaukee & St. Paul—State Line to Hagan 14.00
Devils Lake & Northern—Devils Lake to Starkweather 23.89
Great Northern—Lakota to Edmore 27.00
Minneapolis, St. Paul & Sault Ste. Marie—Hebard to Bismarck 32.60
Northern Pacific—Denhoff to Northwest ..... .63
98.12

NEBRASKA.

Fremont, Elkhorn & Missouri Valley—Verdigre to State line 59.97
Union Pacific—Cedar Rapids to Spalding 13.08
73.05

NEVADA.

Southern Pacific—Rebuilt line, involving change of route, Wadsworth to Brown, 55 miles; Elko to Carlin, 40 miles; total 95.00

NEW MEXICO.

Arizona & New Mexico—Lordsburg to State line 28.00
Dawson—Tucumcari to Dawson 133.00
El Paso & Southwestern—Extension to Rodo 49.00
El Paso-Rock Island—Not specified 69.60
279.60

NEW YORK.

Buffalo, Attica & Arcade—From end of line 3.00
Delaware & Hudson—Moreau to South Glens Falls, 4.81 miles; Junction to Bakers Falls, 1.80; total .. 6.61
Ellenville & Kingston (N. Y., O. & W.)—Ellenville to Kingston 27.50
Glenfield & Western 8.00
Jamestown, Chautauqua & Lake Erie—Westfield extension 7.75
Mohawk & Malone 0.72
Norwood & St. Lawrence—Norwood, N. Y. to Raymondsville 3.00
South Buffalo—West Seneca to Buffalo 6.60
63.18

NORTH CAROLINA.

Aberdeen & Rock Fish—Not specified 4.00
Cape Fear & Northern—Extension from near Angier to Apex 4.00
Cashie & Chowan—Bertie County 13.00
Durham & Charlotte—Star to Troy, 6.57 miles; Spies to Star, 7.00 miles; total 13.57
East Carolina—Extensions towards Farmville 3.00
Oxford & Coast Line—Dickinson to Oxford 5.00
South & Western—Huntdale, N. C., to Boonford, N. C. 25.00
Suffolk & Carolina—Mavaton to Edenton 9.23
76.80

OHIO.

Adena (W. & L. E.)—Adena to Harrisville, 3 miles; Harrisville to Wheeling Valley, 2 miles; total 5.00
Bay Terminal—Rockwell Junction to Navarre Avenue 2.00
Cincinnati, Richmond & Muncie—From end of line ... 6.00
Colorado & Lake Michigan—Lima to Defiance 41.00
Dayton, Lebanon & Cincinnati—Hempstead to Lambeth 3.30
Lake Erie, Alliance & Wheeling—Bergholz to Dillonvale 25.00
Lake Shore & Michigan Southern—Dorset to Latimer 23.80
Northern Ohio—Barberton to Fairlawn 10.00
Toluca Railway & Terminal—Vickens to Paine, 5 miles; Gould to Waldner, 11 miles; total 16.00
132.10

OKLAHOMA.

Atchison, Topeka & Santa Fe—Eastern Oklahoma. Newkirk to Arkansas River, 17.60 miles; Ralston to Pawnee, 14 miles; Ripley to Cushing, 10 miles; Quay to Davenport, 35 miles; total 76.60
Blackwell, Enid & Southwestern—Okeene to Arapahoe, 53 miles; Cordell to Red River, 80 miles; total 133.00
Choctaw, Oklahoma & Gulf—Tecumseh Junction to South Canadian River, 24.86 miles; Geary to Anthony, Kan., .57 mile; Guthrie to Chandler, Okla. T., 10 miles; total 35.43
Chicago, Rock Island & Pacific—Lawton southwest, 21 miles; Lawton to Waurika, 41 miles; Watonga to Anadarko, 60 miles; total 122.00
Denver, Enid & Gulf—Enid to Marshall; Marshall to Guthrie 57.00
Oklahoma City & Western (St. L. & S. F.)—Oklahoma City to Leger 146.00
570.03

OREGON.

Oregon & Southeastern—Cottage Grove to end of track, 8 miles beyond Red Rock 16.00
Oregon Railroad & Navigation—Albina to St. Johns 5.00
21.00

PENNSYLVANIA.

Baltimore & Ohio—Friedens, Pa., to Boswell, 15.8 miles; mine No. 1, Pa., to mine No. 2, 2 miles; total 17.80
Bessemer & Lake Erie 8.87
Cammal & Black Forest—Naval Run Junction to Naval Run 6.00
Cornwall & Lebanon 1.35
Dahoga & Highland 18.00
Delaware, Susquehanna & Schuylkill ..... .57
Delaware Valley—Coolbaghs, Pa., to Bushkill 6.00
Eagles Mere—Eagles Mere to Eagles Mere Chautauqua 2.00
Hickory Valley—Endeavor to Queen 5.00
Leetonia ..... .25
Lehigh Valley 1.45
Lines West—Leesburgh to Coal Mine, 13.7 miles; O. C. Ry. south of bridge to P. C. & Y. station west of Duff Station, 2 miles; total 15.70
Mount Jewett, Kinzua & Riterville 6.02
New Castle & Lowell 7.00
New York Central & Hudson River—Brown, Pa., to McElhattan; Karthaus, Pa., to Clearfield 31.22
Northampton—Nazareth to Stockertown 4.20
Oleona 8.07
Pennsylvania—Cove Forge to Aqueduct, 4 miles; extension Cambria & Clearfield division, 5 miles; line changes near Brinton, 3 miles; total 12.00
Philadelphia & Chesapeake Valley 2.44
Philadelphia & Reading—Hazleton and Tamaqua extension 12.00
Pittsburgh & Lake Erie—Fayette City to Brownsville 8.50
Pittsburgh, Shawmut & Northern—Weedville to Cardiff, 3 miles; Clermont to Kasson, 7.40 miles; total 10.40
Scootac Mountain—New line down south fork of South Creek to the mines of the Burns Fire Brick Co. 6.00
West Side Belt—Shalerville, Pa., to Bruce 9.00
199.84

SOUTH CAROLINA.

Chesterfield & Lancaster—Chesterfield to Ruby 6.00

SOUTH DAKOTA.

Chicago, Milwaukee & St. Paul—Eureka to State line 14.00
Fremont, Elkhorn & Missouri Valley, State line to near Bonesteel 10.00
Minneapolis, St. Paul & Sault Ste. Marie, State line to Pollock 33.56
57.56

TENNESSEE.

Campbell Coal & Coke extension 2.00
Little River—Walland to forks of Little River 11.00
Nashville, Chattanooga & St. Louis—Bridgeport to Needmore line 2.00
Southern—Not specified 1.76
Tennessee Central—Lebanon to Nashville 32.30
Virginia & South Western—extension from Taylor mines to No Name 1.25
50.31

TEXAS.

Atchison, Topeka & Santa Fe (Gulf, Beaumont & Kansas City line)—Rogan to San Augustine 59.00
Cane Belt—Bay City to Matagorda 21.66
Chicago, Rock Island & Texas—Jacksboro to Graham 26.55
Choctaw, Oklahoma & Gulf—Texas State Line to Amarillo 83.34
Dallas, Cleburne & South-Western—Egan to Keene, 5 miles; Keene to Cleburne, 5 miles; total 10.00
Eastern Texas—Kennard Mill to Kennard 3.30
El Paso Terminal 4.50
Fort Worth & Rio Grande—Brownwood to Ceres 20.28
Houston & Texas Central—Burnet to Lampasas 23.00
International & Great Northern—Tucker to salt mines, 4 miles; Waco to Fort Worth, 94.7 miles; total 98.70
Penitentiary road to haul sugar from State Convict Plantation 6.00
Red River, Texas & Southern—Sherman to Carrollton, 52.99 miles; Frisco Junction to West Yards, 4.56 miles; total 57.54
St. Louis South-Western of Texas—Renner to Dallas 13.00
Texas & Louisiana—Long Leaf to Monterey 3.00
Texas & New Orleans—End of track to Jacksonville, 10.4 miles; Van Vleck to Bay City, 6.4 miles; total 16.80
Texas Central—Ross to main line, .75 mile; Waco to Ross, 11.25 miles; total 12.00
Texas Short Line—Grand Saline to Hoyt 10.00
Texas Southern—S. & W. Wye to Gilmer, 16 miles; Harleton to Ashland, 9 miles; total 27.00
495.67

UTAH.

Oregon Short Line—Salt Lake City to Terminus, 38.3; Leamington Hill to Twin Cuts, 15.5; Brighton to Corinne, 4; total 58.00
Rio Grande Western, Bingham branch—Bingham to mines 3.00
Southern Pacific—Ogden-Lucin cut-off; west from Ogden 20.00
81.00

VERMONT.

Clarendon & Pittsford—Pittsford to Florence 2.00

VIRGINIA.

Atlantic Coast Line—Fox to Emporia, 3.00; Chester to Walthall, 2.00; total 5.00
Heald timber road—Extension from Coleman's 5.00
Indian Creek & Pound River—Norton to Cartersville 14.00
Lick Creek & Lake Erie—St. Paul to Turkey Foot .. 8.00
Norfolk & Southern—Virginia Beach to Cape Henry .. 5.50
Norfolk & Western—Speedwell extension, 6.5 miles; Washington Mills extension, 5.5 miles; Chestnut Creek branch, 2.64 miles; total 14.64
Virginia, Carolina & Beaver Dam—Damascus to Cornett's 2.00
54.14

WASHINGTON.

Great Northern (Seattle & Northern)—Chuckanut cut-off, 20.00; (Spokane Falls & Northern), Marcus to Republic, 73.00; total 93.00
Northern Pacific—Extension north from Gould, 4.87; extension from a point 5 miles west of Hoquiam to the Humptulips River, 9.3; total 14.17
Oregon Railroad & Navigation—Dayton to Turner .. 11.00
Portland, Vancouver & Yakima, Battle Ground to Yacolt 15.00
Tacoma Eastern—Kapousin to Ehop 6.00
139.17

WEST VIRGINIA.

Alexander & Rich Mountain—Long Run to Camp 0.60
Belington & Beaver Creek—Belington to Weaver 7.00
Charleston, Clendennin & Sutton—Extension from Otter towards Sutton, estimated at 10.00
Chesapeake & Ohio—Acme to Kayford, 1.5; Leewood to end of line, 6.4; Marlington to Durbin, 14.96; total 22.86
Clover Run—Parsons to Clover Run 5.50
Crabtree & Piedmont (B. & O.)—Extension to lumber tract owned by Du Bois & Bond 5.00
Holly River & Addison—Palmer to Addison 12.00
Iron Mountain & Greenbrier—White Sulphur to Shyrock 15.00
Morgantown & Kingwood—County line to Masontown 3.00
Norfolk & Western—Extension of Crane Creek branch, 7.67; extension to Briar Mountain, 2.12; extension of Thacker branch, 2.23; extension of Tug Fork branch, 6; total 18.02
Porter's Creek & Gauley—Adonijah to Middle Creek .. 10.00
West Virginia Central & Pittsburg—Switch back to end of track, 3.5; Elkins to Cheat Crossing, 21; total 24.50
Coal road from junction with C. & O. to fields in Fayette County 7.00
140.48

WISCONSIN.

Chicago & North Western, Eau Claire, Chippewa Falls & North Eastern line, Chippewa Falls to Stillhawn. 34.05
Chippewa Valley & North Western line, Birchwood to Ladisson, 23.5; other extensions, not specified, 12 miles; total 70.00
Chicago, St. Paul, Minneapolis & Omaha—Spring Valley to Elmwood 7.00
Dunbar & Wausaukee—Dunbar to Holmes 12.00
Hawthorne, Nebagamon & Superior 8.50
Marinette, Tomahawk & Western—Extension from a point two miles east of Gleason to end of track, 12 miles; from Spirit Falls to end of track, 1.5 miles; total 13.50
Northern Pacific—Iron River to Washburn 34.00
146.50

Canada.

Atlantic & Lake Superior—New Carlisle to Paspebiac, Que. 2.00
Bay of Quinte—Deseronto to Napanee, Ont. 6.00
Canadian Northern—Neepawa Jn. to Neepawa 33.00
Canadian Pacific—Extension northwest from Yorkton, 30 miles; Pheasant Hills branch, 40 miles, northwest from Kirkella; west from Forrest, 26 miles; Waskada toward Lyleton, 20 miles; Snowflake toward Mowbray, 10 miles; Wellwood toward Brookdale, 10 miles; Field toward Ottertail, 7 miles; completion of Lardo-Gerrard line, 10 miles; West Selkirk toward Winnipeg Beach, 26 miles completed; total 179.00
Cape Breton—Point Tupper to St. Peters, N. S. 30.00
Edmonton, Yukon & Pacific (Canadian Northern) ... 4.00
Great Northern—St. Vincent-Emerson line 0.75
Intercolonial—Riviere Ouelle to St. Denis, Que 6.00
Lake Erie & Detroit River—Changes in line, Ont 2.18
Nosbonsing & Nipissing—Between points named 5.00
Tilsonburg, Lake Erie & Pacific—Port Burwell to Ingersoll, Ont. 35.00
Vancouver & Lulu Island—Eburne to Stariston, B. C. 8.40
Washington & Great Northern—Cascade to Carson, B. C. 15.00
341.63

Mexico.

Cananea Consolidated Copper extension 3.00
Coahuila & Pacific—Viesca to Torreon 44.00
Durango Central—Conejos to Desenbridora 31.00
Interoceanic of Mexico—Cuantia to Chietla, 14 miles; Vineyes to San Nicolas, 45 miles; total 59.00
Mexican Central—Tinguindin to Los Reyes 12.00
Mexican International—Not specified 33.00
Nacozari—Cima to Cos 34.00
Pan American—Arista to Aurora 30.00
Parral & Durango—Llano Blanco to Mesa de Sandia, Durango 3.75
Toluca & Tenango—Extension from end of line 3.00
Vera Cruz & Pacific—Vera Cruz to Tierra Blanca, 62 miles; Perez to Santa Lucrecia, 78 miles; total 140.00
392.75

Some Features of the Labor System and Management at the Baldwin Locomotive Works.*

BY JOHN W. CONVERSE.

The secret of the success of the American manufacturer, that which enables him to turn out a uniformly good article in a short time and at a low cost, lies in the energy of his production. The chief element in this production is the personnel, the character and method of treatment of the labor employed. The American manufacturer has realized the fact that to get the best result and the largest output from his plant the interest of his laborer and himself must be in harmony. This is not a sentimental theory but sound business policy. It is to the advantage of the employer to pay high wages for good work quickly and accurately done, rather than to pay low wages for slow and slovenly work. The laborer does better when he realizes that his work is appreciated and that increased effort and diligence meet with substantial recognition and reward. The workman is encouraged to exercise his brain and is given extra pay or promoted for having done something or discovered something to the advantage of his employer.

Philadelphia's prominence as a manufacturing city affords a labor market unsurpassed in quality and quantity anywhere in the United States. The large permanent population of skilled mechanics employed in the iron and steel industries of Philadelphia gives an abundant force from which to draw. These men are mostly Americans and of a high grade of intelligence.

Some features which may be of interest in the method of management of labor at the Baldwin Locomotive Works will be treated in this paper.

When locomotives first came into use they were comparatively simple in design and construction. They were built to haul a light load on a level track or on easy grades. As the number of railroads increased and the conditions of service became more severe and diversified, the types of locomotives began to multiply and the process of manufacture became more and more complex. A system of classifying the locomotives constructed was, therefore, adopted. It has been in operation for about 50 years and forms the basis of the shop practice. The system originally involved the classification of the locomotive by the number of driving wheels and the weight of the engine. As the types multiplied still more, however, it was found that this method did not differentiate the classes sufficiently and it was subsequently modified. It is now based on the number and arrangement of the driving and truck wheels, and the size and number of the cylinders. Space will not permit a detailed description of the method: similarity with the principle used in botanical scientific nomenclature, the locomotives are reduced to their genus and species by means of a combination of figures and letters, which indicate the total number of wheels under the engine, the number of driving wheels, the diameter of the cylinders and whether they are single expansion or compound.

Every locomotive and every part of the locomotive is put on paper in the drawing-room before any work is done in the shop. Every class of locomotives has different modifications within the class. These modifications may take the form of an increase in the diameter of the boiler, increase in length of piston stroke, and so on. Every such modification is given a drawing number. All the drawings are filed and a careful record kept of them. In this manner the work of the drawing-room is simplified, new drawings only having to be made when conditions of service arise to which the old drawing will not adapt itself.

By this method, also, the work in the shop is simplified. All locomotives of a given class and drawing being uniform throughout, a system of gages and templates is in use by which all the parts of locomotives of the same class are interchangeable.

The capacity of the establishment is thirty locomotives a week. Orders are allotted spaces in the week in which delivery is promised. If a new design has to be made, the drawing must be completed and data submitted to the purchasing department for ordering material at least a month before the work is to go to the shop. All parts of locomotives and tenders, except boiler and tank plates, steel tires and steel castings, chilled wheels, boiler tubes and special patented appliances are made from the raw materials. All raw materials and all parts ordered by the purchasing department are ordered for a definite locomotive or a number of locomotives of a particular class and must be invoiced as such.

The foremen of the different shops where the various component parts of the locomotive are made are furnished a list, bearing the class designation of the locomotives for which the parts made in his shop are intended. When the drawings are furnished him he allots the work and sees to it that it is finished by the time specified on the

*Advance sheets from the Annals of the American Academy of Political Science.

list. Each part is marked with the class designation of the locomotive for which it is intended. Each workman reports to the timekeeper through his boss or through the foreman his time for each piece and the locomotive for which the piece was intended. All these component parts are assembled in the erecting shop at the appointed time, and, by means of this unit system, the finished locomotive is put together without confusion or unnecessary delay.

A further advantage of this unit system of production appears in the accounting department. Two sets of books are kept—a financial and a manufacturing set. In the financial department accounts are kept of sales, purchases and expenditures. In the manufacturing books a separate account is opened with each locomotive and the material entering into its construction and the labor expended on it are charged against that locomotive. At the end of the year these two sets of books must balance each other. By this method the actual cost of each locomotive is obtained with accuracy and, allowing for fluctuations in price of raw materials, correct quotations can be made for any class of engine.

It is upon this unit system of locomotive classification, by means of which the identity of each locomotive is preserved, that the system of the labor organization and the management of the establishment is based. Having mentioned the chief points in the method of manufacture, let us glance at the personnel of the men.

About thirteen thousand men are on the payroll of the Baldwin Locomotive Works at the present time. The majority of these are Americans, although representatives of nearly every nationality on the face of the globe are found among them. The only requirements of an employee are a good record, a fair amount of intelligence and a willingness and ability to do the work. About 10 per cent. of the total number employed are boys under the age of nineteen years. A large proportion of these are apprentices being taught a trade.

A great variety of skilled labor is employed; some of the different kinds are iron-founders, brass-founders, blacksmiths, machinists of all kinds, wood-workers, tinners, carpenters, painters, copper-workers, plasterers and sheet-iron workers. A skilled laborer is here understood to mean one who is familiar with the use of a tool, a machine or a process; an unskilled workman is one who cannot run a tool, but does ordinary laboring work. The number of skilled and unskilled workmen is divided in the ratio of about two-thirds skilled to one-third unskilled.

Wages are reckoned by the hour and not by the day. Unskilled laborers have a per-hour rating. Piece-work wages, for convenience in accounting, are equated to a per hour rate. A piece-worker can earn the equivalent of from 18 to 50 cents an hour, according to the character of the work and the ability of the man. The average wage of skilled labor is 25 cents per hour. The average wage of unskilled labor is about 14 cents per hour. The men are paid on Friday for their time in the preceding week. Each man has a number which is assigned to him on entering the employ of the Baldwin Locomotive Works. Each shop has a given block of numbers for its quota of men. When the whistle blows to stop work at six o'clock on Friday the men in the different shops file by certain booths, each giving his number and receiving his pay envelope, which contains in coin the amount due him, and on which is written the name, number and amount. Payment is made in coin to insure accuracy and a saving of time in making up the amounts.

The shops are run continuously twenty-three hours a day and the force is divided into day and night shifts. The day shift is on at seven and off at six, with an hour from twelve to one for lunch; the night shift goes on at six and off at seven in the morning, having twenty minute for lunch at midnight. A monitor whistle blows at three minutes before the hour at seven and one; at the hour each workman is required to be at his place and commence work when the signal is given. When late, a workman must secure a "late pass" at the office, which must be presented to the watchman at the gate before he is allowed to report for work. A time-worker is fined according to the time he is late, an hour's time for the first hour or fraction thereof he is late, fifteen minutes' time for each quarter of an hour or fraction thereof he is late thereafter. Piece-workers are fined one hour's rate no matter how late they are. Workmen quitting or preparing to quit before the stop signal is given are fined one hour's time. As time is money when so many men are employed, the rules regulating attendance are strictly enforced. The moral effect of the "late pass" on the foreman's desk is quite an aid to punctuality.

Each workman must know before commencing a piece of work that it will finish to the sizes marked on the sketch or card given him and whether the work is to be completed by himself or others. A rigid system of inspection is enforced in the shops to insure the work being done properly and accurately. Damage for spoiled work is charged to the workman, unless occurring from a reasonable cause, and must be reported at once to the foreman. A workman accepting a piece of work from another to finish is held responsible for any errors in the work of his predecessor. Work must be kept neatly filed and properly marked with the class designation and number of the locomotive for which the piece is destined, and each succeeding workman must see that the mark is continued on work finished by him. All work, as soon as completed at one machine, must be delivered to the next succeeding machine. Economy in the use of material of all kinds, oil, waste, emery, files, etc., is strictly enjoined on every workman. Workmen are not allowed to cut new material when pieces can be had that will answer.

Each employee is responsible for the tools placed in his charge on commencing work, and upon leaving the employ of the establishment he must deliver the key of his box or drawer to the foreman and satisfy him that the stock of tools is complete and in proper order. Each workman is required to keep his bench, vise, lathe, forge, machine or whatever tool or place at which he is employed cleaned and free from rubbish. Careless damage to a tool is charged to the workman.

A workman whose machine breaks down through no fault of his own, or while waiting for work, receives a per hour rate proportionate to his piece-rate. A workman running two or more machines on piece-work, however, is not paid an hour rate for time lost by one machine on account of a breakdown, or while waiting for work.

Workmen are required to report to the timekeepers as follows: Number of hours per day; name of machine; designation of engine or job for which the part is made; when commenced and when finished. Piece-workmen are required to return and charge all their completed work in the week in which it is finished. They do not receive pay for their work unless they comply with this regulation. Piece-workers personally see that timekeepers get their correct time daily; they also must enter on their slates, each evening before leaving the works, their time for the day.

Having glanced at the personnel of the workmen, we will discuss some phases of the system which present themselves. The unit system of production makes it desirable that all work should be turned out by the piece. In the Baldwin Locomotive Works two forms of piece-work are represented, viz.: Piece-work proper, where the workman is paid according to the quantity produced; and the contract system, where the sub-foremen, called contractors, are entrusted with the execution of a portion of the work on a locomotive; for example, the entire construction of the cylinders, or the erection of a certain number of tanks. The contractor has entire charge of the job, seeing that the raw material is delivered promptly, that the men are prompt and diligent, that tools are in repair and machines do not break down. The contractor is paid for the job, the firm paying directly to each workman for the labor on the job. The contractor cannot, therefore, get more than the amount due him on any one job by curtailing the wages of his labor. The contractor is a piece-worker on a larger scale. As he is paid by the job, he has an incentive to turn out his work as quickly as possible and to get as much work as possible out of the men under him.

The following occurrence illustrates the value of the contract system in expediting work: Tanks are built exclusively in one of the shops comprised in the works. The frames and bodies are built on the third floor and taken down in an elevator to the first floor, where they are erected over the trucks. The elevator broke down and the job was held up. The contractor was losing money, as he could not turn out his tanks. The elevator was running inside of two days; in the ordinary course of events a week would probably have been taken to put it in running order.

The contract and piece-work systems insure quantity of product; a rigid system of inspection insures quality of product. In order to insure good workmanship an extremely rigid system of inspection is maintained and contractors and piece-workers are held to strict account if the quality of their work falls below the standard.

Another feature of the piece-work system which is at the same time an advantage and a disadvantage is the specialization which it naturally entails. In the kind of machine work done at the Baldwin Locomotive Works the same operation is performed over and over again many times. The piece-worker, doing the same thing repeatedly, soon finds out the best and quickest way to to do the work and, as he can make more money doing his specialty, he is naturally unwilling to be shifted to another machine or another class of work. The tendency of this specialization is to limit the workman to a single process, and, as a result, the general mechanic has threatened to become practically extinct, to the detriment of manufacturing interests generally.

To remedy this disadvantage an apprenticeship system was inaugurated at the Baldwin Locomotive Works in March, 1901. The apprentices taken on are divided into three classes, as follows:

First class apprentices comprise boys who have had a good common school education and are not over seventeen years and three months of age. They are indentured for four years. An apprentice of this class is required to attend at least two evenings in each week during the first three years of his apprenticeship, free night schools, such as during the first year will teach him elementary algebra and geometry, and during the remaining two years shall teach him the rudiments of mechanical drawing.

Applications for indenture as second class apprentices are considered from boys who have had an advanced grammar or high school training, and are not over eighteen years of age. The term for this class is three years. The apprentice is required to attend night schools, which shall teach him the rudiments of mechanical drawing, for the first two years of his indenture.

The third class indenture is in the form of an agreement made with persons twenty-one years of age or over, who are graduates of colleges, technical schools, or scientific institutions, having taken courses covering the higher mathematics and the natural sciences, and who desire to secure instruction in practical shop work.

The indentures or agreement in each case place upon the firm the obligation to teach the apprentice his art thoroughly and to furnish him abundant opportunity to acquire a practical knowledge of mechanical business The firm also is bound to retain the apprentice in service until he has completed the term provided for in the indenture or agreement, provided his services and conduct are satisfactory. In all cases the firm reserves the right to dismiss the apprentice for cause.

The rates of pay in the different classes are as follows:

	1st year, per hr.	2d year, per hr.	3d year, per hr.	4th year, per hr.
Apprentices of the first class...	5c.	7c.	9c.	11c.
Apprentices of the second class.	7c.	9c.	11c.	..
Apprentices of the third class...	1st 6 mos. of 1st year, 13c. per hr.; 2d 6 mos. of 1st year, 16c. per hr.; 1st 6 mos. of 2d year, 18c. per hr.; 2d 6 mos. of 2d year, 20c. per hr.			

In addition to the rates mentioned above, apprentices of the first class each receive an additional sum of $125.00, and apprentices of the second class an additional sum of $100.00 at the expiration of their full terms of apprenticeship, respectively.

The apprentices are under the direct supervision of a superintendent and a careful record is kept of the performance of each. The apprentices are put to work in the shop on the different machines, millers, slotters, planers, lathes, boring machines, etc. They are shifted to a different machine every three months and an account of their work entered in the superintendent's book. Apprentices of the third class are shifted as often as they wish from one machine to another. On the completion of his indenture, if he wishes it, and his record has been satisfactory, the apprentice can secure a good position at the works, at the start generally as track boss, inspector, or in some such capacity. There are about three hundred apprentices on the books at the present time; about two hundred of them are in the first, about sixty in the second and about forty in the third class. The object is to turn out good, all-around machinists and good results are hoped for from the system.

The policy of the firm is to make the interest of the men identical with its own. Hard work is required, but high wages are paid, ingenuity is encouraged and intelligent and faithful work is liberally rewarded. Piece-rates are seldom cut and then only on account of the introduction of a time-saving tool or in the stress of keen competition. The policy is to maintain a uniform piece-rate for all the men doing a certain class of work. If one man shows especially marked ability, he may be shifted to another job, usually being made a contractor or sub-foreman. The policy of the establishment is to make promotions from within; foremen, bosses or superintendents are not imported.

Strikes are practically unknown. If a man has any grievance he can submit it to the superintendent and he knows that his complaint will receive careful consideration and that he will be dealt with fairly. No one is questioned, when he enters the employ, whether he is affiliated with a trades union or not, but trades unionism does not flourish at the works.

A pleasing and noteworthy feature of the attftude of the men is the *esprit de corps* which prevails. They realize that their employers are doing their best for them and only ask in return the best work of each man. Every man is proud of the establishment he works for, the oldest of its kind in the country, and every man is proud to be known as a Baldwin man.

Cars or Terminals?

We lately quoted Mr. Hawks as having said that the real obstruction to the movement of freight is not a matter of cars or locomotives so much as of terminals and yards. In looking over some old correspondence we find the following letter, which was written in December, 1891. The writer was the general manager of one of the great northwestern roads. The reader will observe that the question is not altogether a new one.

"The present difficulty in moving the products of the western country, generally attributed to scarcity of cars, is chiefly owing to the relative incapacity of terminals. The movement is beyond the power of digesting and distributing at those points. This is especially true to-day of Chicago and Buffalo. From the time the crop began moving freely until the close of navigation, none of the railroads serving the west and northwest were (and probably few of them are) able to fully supply the demand for cars; but had the supply been equal to the demand, it would have resulted in greater accumulation of loaded cars at terminal points, consequent congestion, and much less freedom of movement than has taken place. As soon as the surplus of cars (whatever it might have been) was filled with grain, the movement would have been governed by the capacity of terminals, either those immediately reached by lines in question or by their connecting lines, and the cars in excess would have simply choked the way. My observation and experience is that while more cars would have been acceptable and in many cases available for business, the crop as a whole, up to the close of navigation, moved with unusual freedom, and from the northwestern country in much greater volume than ever went out before in the same length of time. I am glad to say there is a great deal more to come. The movement this winter will, to a considerable extent, be dependent upon the ability of the trunk lines to clear the way.

Determining the Size of Railroad Culverts.

BY S. WHINERY, C. E.

In too many cases the determination of the proper size or capacity of the culverts on a line of new railroad does not receive the careful attention its importance demands. Not infrequently it is made a matter of off-hand judgment or guesswork. The engineer rides or walks over the located line, looks at the various ravines and small streams and from their general appearance at the place of crossing, notes the size and character of opening that seems appropriate, and then dismisses the matter from his mind. If he be a man of good judgment and wide experience these off-hand decisions may not be far wrong. If otherwise, a considerable number, at least, of the waterways thus determined upon are sure to be either too small or too large. They are more likely to be unnecessarily large, for the engineer knows very well that if a culvert be made too small and be washed out by the first very high water his blunder will come to the attention of his superiors and he will be unfavorably criticised, while if he makes the waterway unnecessarily large, nobody is likely to discover the fact, and even should it be discovered he may plead the wisdom of always being on the safe side. Hence, have arisen such rules as that published in one of our leading engineering papers a few years since, with the remark that there was the best authority for following it: "Estimate the largest possible area that seems to be required and then multiply it by two."

That some such rule has been followed in designing the waterways of many railroads must become evident to any one who will take the care to look into the matter, even casually. As a single instance within my own knowledge may be mentioned a case on a prominent railroad where a stream draining less than one-third of a square mile is crossed twice in the same half mile. At the upper crossing a 16-ft. arch and at the lower crossing an 18-ft. arch is used, both being built of first-class arch masonry. There can be no doubt that a 10-ft. arch would have afforded ample waterway in each case. In fact, had the engineer who determined the size of the waterways followed the stream a quarter of a mile above the upper crossing he would have discovered that it passed under a rocky ridge, through a curious so-called natural bridge having a waterway of less than 40 sq. ft. in area. As both arches are under embankments of considerable height, the difference between the cost of the two structures actually built and that of structures which would have been ample could not have been less than several thousand dollars. It is fair to say that the stream is fed by several considerable springs which gave it, in dry weather particularly, the appearance of being a much more formidable stream than it actually is; but had the extent of its drainage area been looked up, or had the peculiar natural waterway referred to above been discovered, its true character would have been apparent, and a considerable sum of money would have been saved to the company. On the same mile of road with these two arch culverts is found a 4-ft. arch, where a 2 ft.x3 ft. box culvert would have been ample.

It is anomalous that some engineers who compute with the greatest care, upon elaborate assumptions, the section of every member of a railroad bridge, do not hesitate to guess at the proper size of railroad culverts. It is quite true that the size of culverts cannot be determined with the same degree of accuracy as the dimensions of bridge members, but it is nevertheless entirely practicable to compute the proper area of waterway with approximate correctness by rational methods.

The elements that must enter into such a computation are the following:

First—The area of the drainage basin which the culvert must drain.

Second—The rate of maximum rainfall to be expected in the locality, and the time of its continuance.

Third—The rate at which the water will flow off the drainage area, i. e., the velocity of flow.

Fourth—The portion of the water falling on the drainage area that will reach the culvert, commonly called the "run off."

1. To obtain the area to be drained will require a more or less accurate survey, or the examination of sufficiently accurate maps. In the case of small streams with limited drainage areas the watershed may be traced out with transit or compass and chain, but far more rapid and sufficiently accurate work may be done with a transit having stadia wires or telemeter attachment. In the case of streams of larger size, where the land is divided by government land surveys the points where the watershed crosses the land lines may be ascertained, points between such crossings sketched in, and the boundary plotted from these notes. Often the boundary of the drainage area of larger streams may be located with sufficient accuracy on a good map of the region. Having thus ascertained the boundary line of the drainage basin, its area may be computed in the ordinary way, or by the planimeter, which will save a great deal of time and labor.

2. Our data relating to maximum rainfall are still quite meager. We have a considerable number of isolated observations at various stations that are more or less reliable, and the Government Weather Bureau has now in operation a large number of rain gages which record automatically both the total rainfall and the rate of precipitation. Very few of these have been established long enough to supply reliable data from which to predict the maximum rainfall that may be expected to occur in the various localities where such data is needed, and we are still compelled to resort to estimates based on incomplete information. It is hardly within the scope of this article to go into an extended consideration of this question of maximum rainfall, but it is necessary to briefly discuss the matter and to attempt to arrive at a general conclusion that may serve our purpose until sufficient data has accumulated to dispense with empirical assumptions. In Bulletin D of the U. S. Weather Bureau, entitled "Rainfall of the United States," issued in 1897, is found a tabular statement of excessive rainfalls at Washington, D. C., Savannah, Ga., and St. Louis, Mo., since the establishment of automatic recording rain gages at these stations. These published records are supplemented in the annual reports of the bureau by similar records for the years 1898, 1899, 1900 and 1901.

We have, therefore, records at these three stations covering, with the exception of 1897,* the following periods:

Washington, D. C.....	1881 to 1901 incl.
Savannah, Ga.....	1889 to 1901 "
St. Louis, Mo.....	1889 to 1901 "

The geographical location of these stations is such that these results of the observations may be taken as typical of a large area of the eastern half of the United States.

Using these records we may plot upon a diagram the excessive rainfalls during the periods covered, and may then draw curves which will represent the maximum depth of rain that has been observed to fall in various periods of time from five minutes to two hours. Such curves are shown on Diagram 1. The maximum rainfall for each period of time, and a few of the observations that approach the maximum, are shown by small crosses. These marked observations show the apparently lawless character of these excessive rainstorms, and it is apparent that the location of the curves is a matter of judgment. As drawn, the curves embrace all the observations except those of the excessive precipitation between 45 and 50 minutes in the storm of June 2 and that of June 8, both in 1900, at Washington, and the remarkable storm of July 30, 1898, at St. Louis, which departed so widely from all other records (2.95 in. having fallen in 80 minutes) as to make it phenomenal. The curve for that station has been so drawn that while it does not cover that storm it is located about midway between its extreme observations and the limit of all the other storms recorded. No attempt has been made to include those phenomenal downpours of which we have pretty well authenticated records previous to the date when these continuous government records begin, for reasons which will be stated later on.

While we have not sufficient data to prove or to disprove such an assumption, it would seem reasonable to assume that the maximum rate of rainfall in any locality bears some relation to the normal annual rainfall in that locality. If this assumption be well founded we may reasonably infer that the rate of excessive rainfall in a locality where sufficient records are not available, but where the normal annual rainfall is known, may be approximately predicted by comparing it with the known ratio between normal and excessive rainfall at points where both are known. In other words, if we know that at a station where the normal rainfall is 40

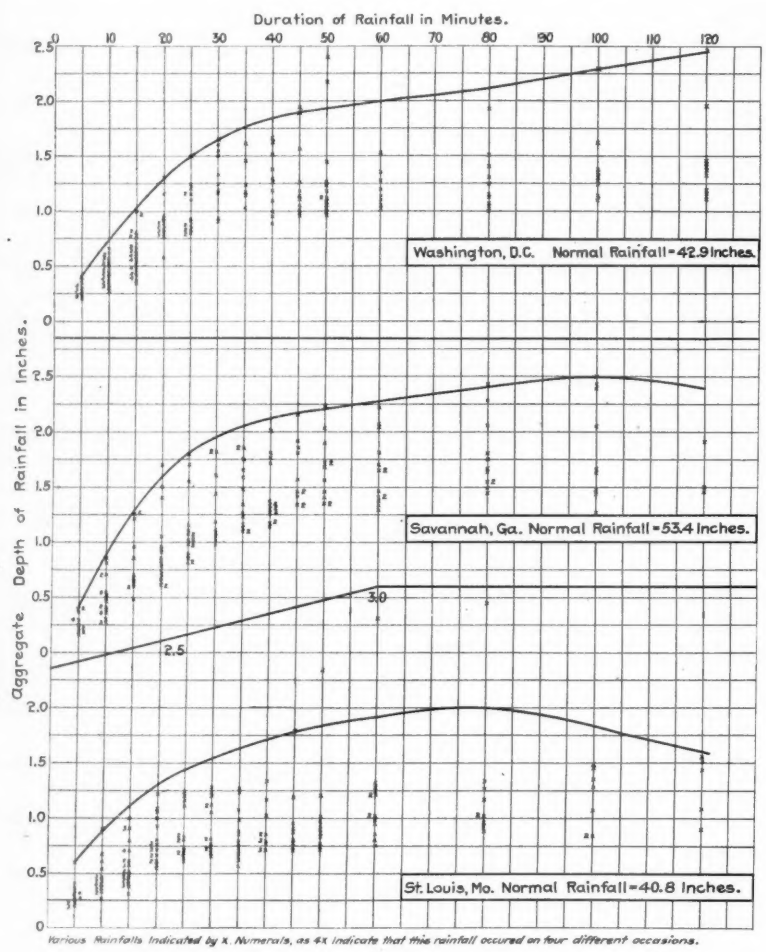


Diagram 1.—Showing Total Accumulated Precipitation in Inches for Each Five Minutes.

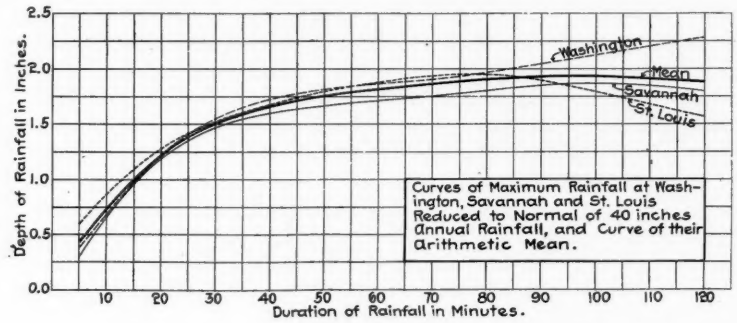


Diagram 2.

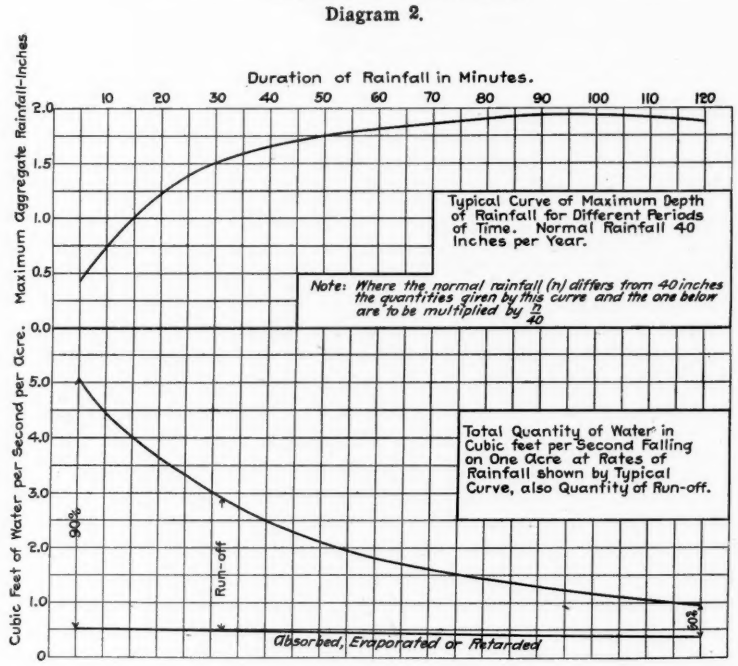


Diagram 3.

*The record for this year may have been published, but if so it is not accessible to me just now.

in., excessive rainfalls of 2 in. in one hour have occurred, we may assume that where the normal rainfall is 50 in., excessive rainfalls of 2½ in. in an hour may be expected. Applying this assumption to the three stations named above, and reducing the curve for each to a normal of 40 in., the curves shown in dotted lines on Diagram 2 are obtained. While these curves do not coincide they show such a degree of approximate coincidence as to justify a tentative conclusion that the assumption made is correct.

If we draw a fourth curve marked "mean," representing the arithmetic mean of the three, it will be observed that the departure of either of the three from this mean curve is so small as to justify us in regarding the mean curve as typical of the excessive rainfall, predicated upon a normal rainfall of 40 in. per annum; and in the absence of reliable observations we may predict that the excessive rainfall in any locality may be determined with rough approximation to the truth by multiplying the rate indicated by this mean curve by the normal rainfall in that locality and dividing the product by 40. We should not, of course, resort to such approximation except in cases where actual data relating to excessive rainfall are not available.

The fact is that, whatever generalizations may be developed in the future, our present knowledge of rainfall indicates a degree of uncertainty and capriciousness that makes any attempt to formulate the laws that govern it very discouraging. We must grope largely in the dark for the present. It seems probable, however, that in the absence of records we shall not go very far wrong in making use of the typical curve shown on Diagram 2. In using it the quantities indicated are to be increased or reduced in the ratio that the normal rainfall of the locality bears to the standard normal assumed, 40 in. This typical curve is reproduced in Diagram 3, and below it is drawn a curve representing the quantity of water, in cubic feet per second, falling upon one acre of ground at the rate of rainfall indicated by the typical curve.

3. The velocity at which water falling upon a surface will flow away is dependent upon a number of elements, but the principal one is the inclination or grade of the surface or the channels along which the water flows. The typical grade profile of a drainage area is not a straight line but a curved one, descending rapidly from the watershed and gradually decreasing in declivity as the stream approaches the plane of the valley. But the greater velocity of flow which the steeper grade near the watershed would indicate is counteracted by the smallness of the streams or rivulets there and the rough and uneven channels. The usual assumption that the velocity of flow is uniform over the whole length of the short streams we have to deal with is probably approximately correct, and in computing the velocity we may consider that the gradient is a regular one from the watershed to the proposed culvert. There seems to be no available data as to the velocity of flow in rivulets and small streams with rough and tortuous channels, but we may apply to them the Kutter formula, using a suitable value of C. Taking a small stream, which we may consider typical of those usually to be provided with culverts, we may compute the velocity for various gradients. The table below assumes a stream 3 ft. wide at the bottom, with side slopes of 45 deg. and with 1½ ft. depth of water in the channel, using a value of C=40, which is probably not too low for the rough and crooked channels of the ordinary small stream.

Table No. 1.—Velocities of Flow in Feet per Second.

Scope.	Velocity in feet per sec.
1 :20	7.06
1 :30	5.75
1 :50	4.46
1 :75	3.64
1 :100	3.15
1 :150	2.57
1 :250	1.99
1 :500	1.41
1 :750	1.15
1 :1000	0.99

In computing the slope or gradient it must be remembered that the length of the stream, because of its crookedness, will always be greater than the air-line distance from the watershed to the culvert, and an allowance, to be determined by the judgment of the engineer, must be made therefor. The average elevation of the watershed above the culvert may be ascertained in any convenient way, but barometrical determinations will usually be sufficiently accurate.

4. In the matter of the part of the rainfall that will flow off from the surface of the ground and reach the culvert we are also without sufficiently reliable data. The fact that maximum run-off must be provided for somewhat simplifies the problem. Varying conditions of soil and surface cause the run-off to vary within wide limits. In small areas with a surface rendered almost impervious by frost or other causes, we will be safe in assuming that 90 per cent. of the total rainfall may reach the culvert. In the larger areas, where the extreme distance between the watershed and the culvert may be as much as 3 miles, a study of the available data seems to indicate that not more than 60 per cent. of the rainfall will reach the culvert, and I have consequently adopted 90 per cent. as the run-off for the shortest periods of rainfall (5 minutes), and 60 per cent. as the maximum run-off from the areas represented by a rainfall of 2 hours.

The line marked "Absorbed, evaporated or retarded" on Plate 3 represents the water absorbed by the soil, or evaporated or held back, for these and intermediate periods of time, and the distance between this line and the curve of rainfall per cubic foot per acre will represent the quantity of water in cubic feet per second that must be provided for at the culvert. The empirical formulæ commonly used to determine the size of sewers do not seem applicable to determining the run-off in the case of culverts, as the conditions in the two cases are quite different, and those formulæ are predicated upon the maximum rate of rainfall per hour, while we have chosen to use the total precipitation at the end of stated intervals of time. An attempt to apply such sewer discharge formulæ to culvert problems will disclose certain apparent anomalies, which we need not here discuss. The near approach of the line of "absorbed" water on Diagram 3 to a horizontal line will be noted. Had we assumed the run-off of 5-minute storms to be 95 per cent. and that of the 2-hour storms to be 71.3 per cent., this line would have become exactly horizontal, indicating that the actual quantity of water held back from the culvert is constant for the rainfalls of the intensity and duration shown by the typical curve. This is an interesting circumstance that invites discussion, but time and space does not permit us to take it up now.

Table No. 2 gives the same data as Diagram 3, and may be used instead of the diagram.

Table No. 2.—Time of Rainfall, Maximum Accumulated Precipitation for That Time, Cubic Feet of Water per Second Falling on One Acre, Percentage of Run-off and Volume of Run-off.

Assumed Normal Rainfall 40 Inches per Annum.

Time in minutes.	Accumulated precipitation for time (typical curve). Inches.	Average cu. ft. per sec. falling on one acre.	Per cent. of run-off.	Volume of run-off per acre. Cu. ft. per sec.
5	0.42	5.082	90.0	4.574
10	0.73	4.417	88.7	3.918
15	1.00	4.033	87.4	3.525
20	1.22	3.690	86.1	3.177
25	1.38	3.339	84.8	2.831
30	1.50	3.025	83.5	2.526
35	1.58	2.731	82.2	2.245
40	1.65	2.496	80.9	2.019
45	1.70	2.286	79.6	1.820
50	1.75	2.118	78.3	1.658
60	1.82	1.835	75.7	1.389
70	1.87	1.616	73.0	1.180
80	1.90	1.437	70.4	1.012
90	1.93	1.297	67.8	0.879
100	1.93	1.168	65.2	0.762
110	1.92	1.056	62.6	0.661
120	1.88	0.948	60.0	0.569

Let us now note what takes place upon a drainage area when a rainstorm occurs over it. We will assume for the present that the drainage area approximates one of two outlines, which may be considered typical. Figure 1 represents a semi-circular, and Figure 2 a rectangular drainage area, the culverts in each case being located at A. It is obvious that when the rain begins to fall, the particles of water falling nearest to A will, in flowing off, first reach and pass that point, and that the particles falling at successive distances from A, b b′, c c′, d d′ and e e′ will reach and pass A at successive intervals of time dependent upon their distance and the velocity of flow. The volume of water reaching and passing A will be continually augmented until the particles falling upon the boundary e e′ shall have reached that point, when the rate of flow will obviously have reached a maximum, and will thereafter remain constant as long as the rain continues to fall at the uniform rate assumed. If, therefore, we know the time required for the water to flow from e e′ to A, and take from Diagram 3 the maximum rate of precipitation to be expected for that period of time, and the equivalent cubic feet of water per second falling upon and running off from one acre, we may, by multiplying this quantity by the area of the drainage basin obtain the volume of water that must be provided for at the culvert.

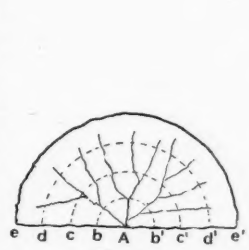


Fig. 1.

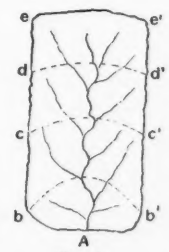


Fig. 2.

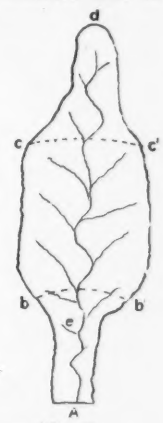


Fig. 3.

Typical Forms of Drainage Basins.

Let us assume, for illustration, that the radius of Figure 1 is 2,000 ft. and that the slope is such that the average velocity of the flowing water will be 4 ft. per second. The area drained is approximately 94 acres. Allowing for an increase of 20 per cent. in the distance traversed by the water (2,400 ft.), the time, in minutes, required for the water falling along the boundary e e′ to reach A will be

$$\frac{2{,}400}{4 \times 60} = 10 \text{ minutes.}$$

Turning to Diagram 3 we find that the maximum aggregate rainfall for ten minutes is 0.73 in., and referring to the lower curve we note that the quantity of water falling upon one acre at that rate is 4.45 cu. ft. per second, and that the expected run-off is 3.95 cu. ft. per second. But this is for localities where the normal rainfall is 40 in. per year, while the normal rainfall in our locality is 50 in. per year. We may therefore expect that the actual quantity of water per acre will be

$$3.95 \times \frac{50}{40} = 4.94$$

cu. ft. per second. The area of the basin being 94 acres we have, as the total quantity of water reaching the culvert in cubic feet per second,

$$4.94 \times 94 = 464.36$$

and we must design our culvert to convey that quantity of water. In actual practice, however, we shall not often meet with drainage areas having the simple and regular form of Figures 1 and 2, and the question at once arises: can the method outlined be applied to drainage areas of other and often irregular forms? To most of them it can be, but its application will require the exercise of some judgment on the part of the engineer. In every drainage area there will be found some combination of the elements of area, time and consequent rate of rainfall, and velocity of flow, that will produce a maximum accumulation of water at the site of the culvert, and a little study of the plat of the drainage area will disclose that combination. Take, for instance, the drainage area represented by Figure 3. It is obvious, almost at a glance, that the maximum of water to be dealt with will occur when the run-off from the area b, c, c′, b′ shall reach the culvert. We may therefore consider this area alone in designing the culvert at A. It is evident that the volume of water flowing in the stream will attain a maximum when the rain falling on c c′ shall have reached the point e, for all the water falling on the area above c c′ must follow that falling on that line and cannot, with the exception noted below, increase the maximum flow. It might occur that the rainfall would continue at such a rate after the time occupied by the water in flowing from c c′ to e as to augment the volume passing e, but the typical curve of rainfall on Diagram 3 shows that the rate of rainfall decreases so rapidly with the time that such an occurrence would be very unlikely. In the same manner the rainfall might continue while the crest of the tide is flowing from e to A, thus augmenting the quantity of water that would reach A, but for the reason given above, this augmentation is likely to be immaterial. If, however, the engineer desires to be entirely upon the safe side he may include in the area that portion of the drainage basin below e, and some portion, as his judgment may dictate, of the area above c c′.

The fact to be here noted is that an intelligent study of the plat of the drainage area will nearly always enable the engineer to select that combination of conditions which will enable him to compute, by the method outlined, the maximum volume of water he will be called upon to provide for.

It may be thought by the reader that, after all, this method of arriving at the proper capacity of a culvert is little better than guesswork, since the value of the factors must be approximated, and the judgment of the engineer must be so largely exercised. It must be admitted that great accuracy cannot be expected in the results. But it may be confidently asserted that the *method* by which the result is reached is rational and correct, and that even with the unavoidable approximations in the values of the several factors better results are sure to be reached than if offhand judgment or purely empirical formulæ are relied upon, even where the area of the drainage basin is known. It would be interesting to discuss this matter further, and to compare the results given by this method with those given by the numerous empirical formulæ that have been published and used, when applied to a drainage area where the conditions admit of fairly accurate computation, but the length of this article, already much too great, forbids it now.

The maximum quantity of water to be accommodated having been ascertained, the size of the culvert may be determined by well known methods, modified by conditions encountered at each location, and by such a factor of safety as the engineer may think prudent.

The question, what allowance should be made for those phenomenal rainstorms that will occur in nearly every locality once in a long time—a quarter of a century, for instance—needs consideration. It is always a debatable question what risks an engineer is justified in taking in the interest of economy. I shall not attempt to discuss the question at length, further than to observe that there must be some limit where the expenditure of money to provide for remote contingencies becomes unwise. No one doubts the possibility of earthquakes in any locality, but in most places the contingency is so remote that we do not consider it advisable to built our houses to resist earthquake shocks. The wisdom of designing railroad culverts of such size that they will pass floods that are only likely to occur in each 25 or 30 years may well be questioned. It must

be remembered in this connection that, usually, railroad culverts are covered by embankments of greater or less height, which would not be much injured if the water should rise above the top of the culvert, in which case the greater head would so increase the discharge through the culvert that phenomenal rainstorms would be taken care of without damage. The possibility of obstruction by drift must also be considered, but it will usually be cheaper to provide devices for preventing such obstructions than to build the culvert large enough to insure the passage of drift through it.

Ordinarily culverts are not used for the drainage of areas larger than will be included in the period of two hours' rainfall, dealt with in the diagrams, and the proper span of bridges is usually determined from flood data obtained upon the spot or in the near locality. It is believed, however, that the method outlined may be applied to determine the flood discharge of rivers whose basins are not so extensive that it would be erroneous to assume a uniform rate of rainfall over the whole area.

Improvements at the Brooks Works of the American Locomotive Company.

During the past five years many additions have been made to the shops and equipment of the Brooks Works of the American Locomotive Company at Dunkirk, New York. In the accompanying illustration the shaded areas indicate the important additions to the buildings. These include an erecting shop 69 ft. x 255 ft. northwest of the old erecting shop, a tank shop 59 ft. x 396 ft. with an L 59 ft. x 217 ft. north of the old boiler shop; a running shed for final inspection before delivery 50 ft. x 170 ft. northwest of the erecting shops; an extension to the south ends of the old erecting and machine shops; a cylinder shop 100 ft. x 275 ft. southeast of the old iron foundry, and a hammer shop 85 ft. x 400 ft. at the southern end of the works. The new erecting shop is a brick and steel structure with 17 erecting pits served by an overhead electric traveling crane of 100 tons capacity.

The new tank shop is thoroughly modern in its appointments. The laying-out floor is at the extreme east end. From here the work passes on to the punches, shears and bending rolls and the completed tanks are assembled and tested at the west end. The frames are made in the side L. The shop is driven by electric motors and several of the machines have motors direct connected. Among the latter class are two machines for simultaneously finishing the ends of the channel beams used in the frame construction.

The extension to the erecting and machine shops is now being used for finishing rods, etc. A two-story addition is now being built over the extension to the machine shop. Eventually it is proposed to carry this two-story addition over the entire machine shop, and it will be used for light machine work. The side walls will consist of small windows set in light frame work and will give a well lighted shop.

The new cylinder shop is a brick and steel structure and consists of a center bay about 50 ft. wide and two side bays sloping from the center each 25 ft. wide. Over the center bay and extending the entire length of the building is a monitor 50 ft. wide and 18 ft. high consisting entirely of glass windows. Exclusive of other windows, this arrangement gives a lighting area of about 10,000 sq. ft., or about one sq. ft. of lighting area to 2¾ sq. ft. of floor space. The gutters in the roof of the lantern have been placed about 3 ft. back from the edge and the roof slopes upward from them in each direction. This permitted the side windows to be brought up higher. The rain pipes are inside the shop and follow the roof and walls to the outside.

The east bay contains the heavy boring mills and planers, the power being furnished by one motor connected to an overhead line shaft. Several of the tools are direct driven by electric motor. At the south end of the east bay is the heating plant. Ducts from the fan lead underground along both sides of the shop.

The lighter class of cylinder work is done in the west bay. Among other tools is one turret lathe for turning and boring eccentrics. Two motors drive this bay—one driving a group of six boring machines for finishing valves, bushings, cover plates, and pistons.

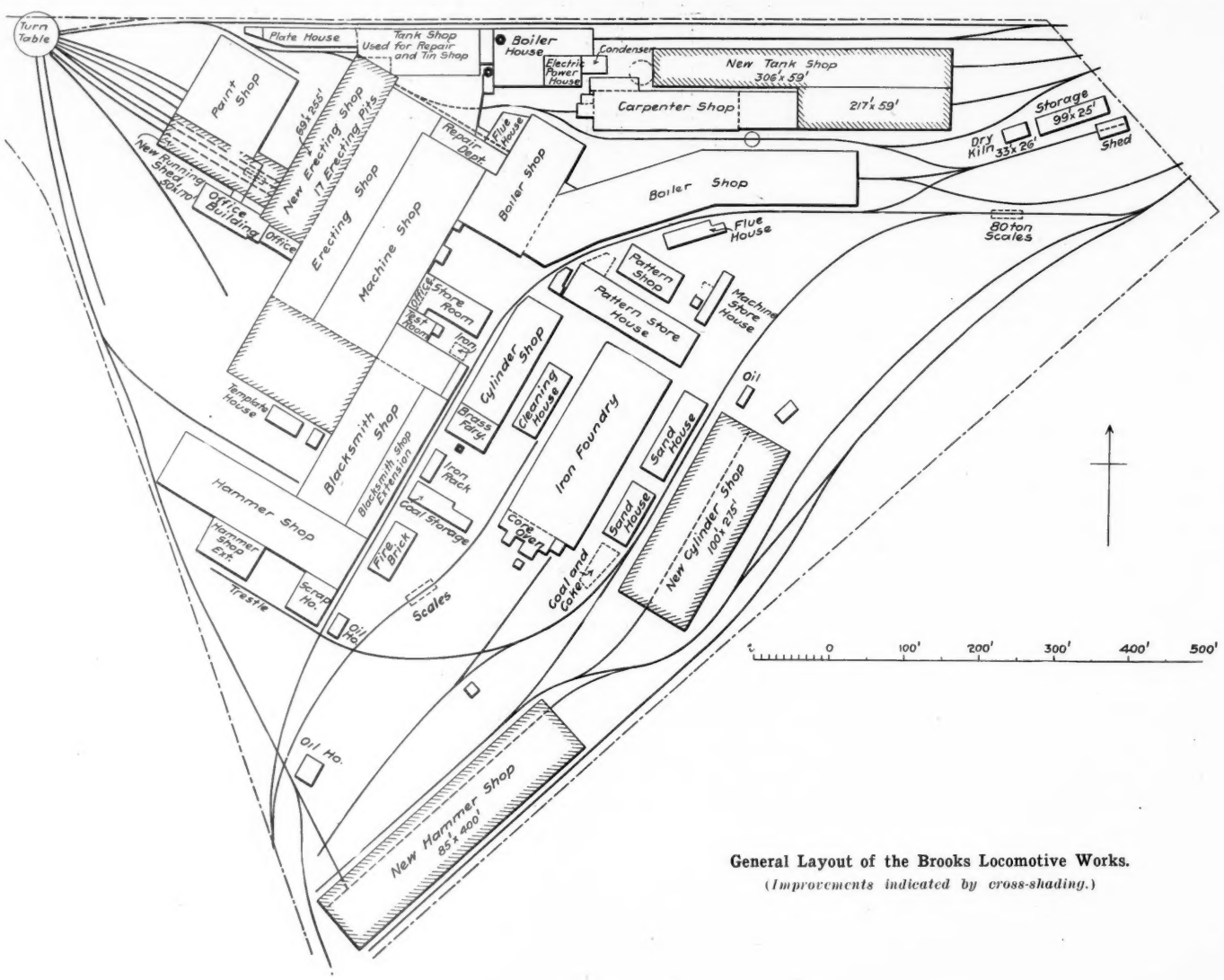
The center bay is served by a 10-ton electric traveling crane. Standard and narrow gage tracks run the length of the center bay, and completed work can be quickly and economically transferred to the erecting shop. The rough castings enter the cylinder shop from the iron foundry through a door at the southwest corner.

The new hammer shop is a brick and steel building without side bays. Along the peak of the roof are six lanterns with swinging windows for ventilation. The roof trusses are of peculiar construction; each truss consisting of two separate parts extending from the side walls but not joining at the peak. This construction was used in order to interrupt the vibrations which might be set up in the truss by the pounding of the hammers. The trusses are braced and tied together both laterally and horizontally.

At present there are three 6,000 lb. steam hammers in operation, each having a separate furnace. Above each furnace is a boiler for utilizing the waste heat, the steam thus generated being used for the hammers. Two 5,000 lb. jib cranes serve each hammer and furnace. Nine hammers will ultimately be installed and the exhaust steam will be used in the coils of the cylinder-shop heating plant.

The boiler power has been augmented by the addition of one battery of Aultman & Taylor water tube boilers and one battery of Babcock & Wilcox boilers, the whole aggregating 1,200 h.p. Another battery of 600 h.p. of Aultman & Taylor boilers is being installed. The new boilers are equipped with automatic chain grate stokers and the Aultman & Taylor boilers have mechanical induced draft. A new 500 h.p. vertical cross compound Buckeye engine, direct connected to a 350 k.w. General Electric Co. direct current 220 volt generator, has been installed.

Before the present improvements were made the total floor space in the works was about 300,000 sq. ft. The above noted additions have increased this figure to about 530,000 sq. ft. The present capacity is about 465 locomotives a year, and this will be increased to about 600 when the present improvements are completed.



General Layout of the Brooks Locomotive Works.
(Improvements indicated by cross-shading.)

An Unrecorded Property of Clay.*

Some years ago the writer found that ordinary clay, such as used for bricks, and commonly spoken of as plastic clay, would, if dried sufficiently to remove nearly all its moisture, lose its cohesive properties, and would, if water were afterwards applied to it in considerable quantities, become an almost liquid mud. On the other hand, clay which has not been so dried will not absorb any more water, and will lose only some of its outside particles in the washing. The writer has been unable to find any reference to this property of the material in question in the text books at his disposal.

It came to his notice under the following circumstances:

The main line of the Canadian Pacific runs for nearly 150 miles through a portion of British Columbia, situated between the eastern slope of the Cascade Range, and the western slope of the Gold Range. There is no regular rainfall over this area, and crops cannot be grown without irrigation. A good many thunderstorms do occur in the summer, but only over very limited areas, and the rainfall from them runs away quickly without soaking into the ground to more than a depth of one or two inches, and is dried off in a few hours by the rapid evaporation incident to the region. . . . Water has been lavished upon the fields for nearly 40 years, and has been the cause of numerous landslides, one of the greatest of which occurred in 1881, when about 100 acres slid forward for nearly a quarter of a mile, falling in that distance about 300 ft., and completely blocking the Thompson river for about three days by forming a dam 75 ft. or more in height. Many similar slides on a smaller scale have occurred since that date, but, generally, with slower movement and less disastrous effect. One of these is of large area and includes a portion of the railroad line; it has required constant watching and has been a cause of much anxiety to the railroad officials, because, although its forward progress has been

*Extracts from a paper by H. J. Cambie, M. Canadian Soc. C. E. Read before that Society Dec. 4, 1902.

slow, it has begun to move, year after year, at a date about three months after the beginning of the irrigation season, and has continued moving for about the same period.

In 1886 the Canadian Pacific Company took legal proceedings against the parties irrigating the fields above this slide, and it devolved upon the writer to furnish the legal advisers for the company with evidence to prove that the slide was due to the action of irrigation water. An investigation was made by the writer in consultation with Messrs. Stanton and Schuyler, who were employed by the company, as experts in hydraulic engineering, and, particularly, in irrigation practice, and with Mr. H. J. Warsap, Manager of the Canadian Pacific Railway Portland Cement Works at Vancouver, an expert in clays. At the slides were found beds of clay so exceedingly dry and hard as to have the appearance of soft sand stone, and still retaining the marks of picks in the slopes of cuttings, where dressed many years ago. When a block of this dry indurated clay was placed in a soup plate and water dropped upon it, the clay absorbed 50 per cent. of its own weight without any change of form or other visible effect, but when it had absorbed about 60 per cent. of water, its structure completely collapsed, and it became as fluid as water.

This was considered by us as conclusive evidence that the irrigation water which had been poured for weeks and months on these beds of clay had been the cause of the slide, but, in court, his argument was met by a demand from the opposing counsel to be told why the bluffs of this material, which were washed at their base by the river, did not disintegrate and slide. Several ingenious theories were offered to account for this, but were not convincing, and the writer now thinks that it was because these bluffs had never been dried out below high water mark, and the material in them, therefore, did not possess the property of soaking up water and of finally collapsing. . . .

A year or more after the trial, the writer, while experimenting with Mr. Warsap on some clay, which had been dried for other purposes, found that it gave the very same results as the dry clay from the interior of the Province. This led to experiments with other clay, and it was found that they all lost their cohesive properties when the moisture was removed.

It is probable that this property of clay has been the cause of many of the landslides which have occurred this year in the valley of the Oldman and Belly Rivers, between Medicine Hat and the Crow's Nest Pass, for there has been an exceedingly heavy rainfall over these valleys during the year for the first time since they have become known.

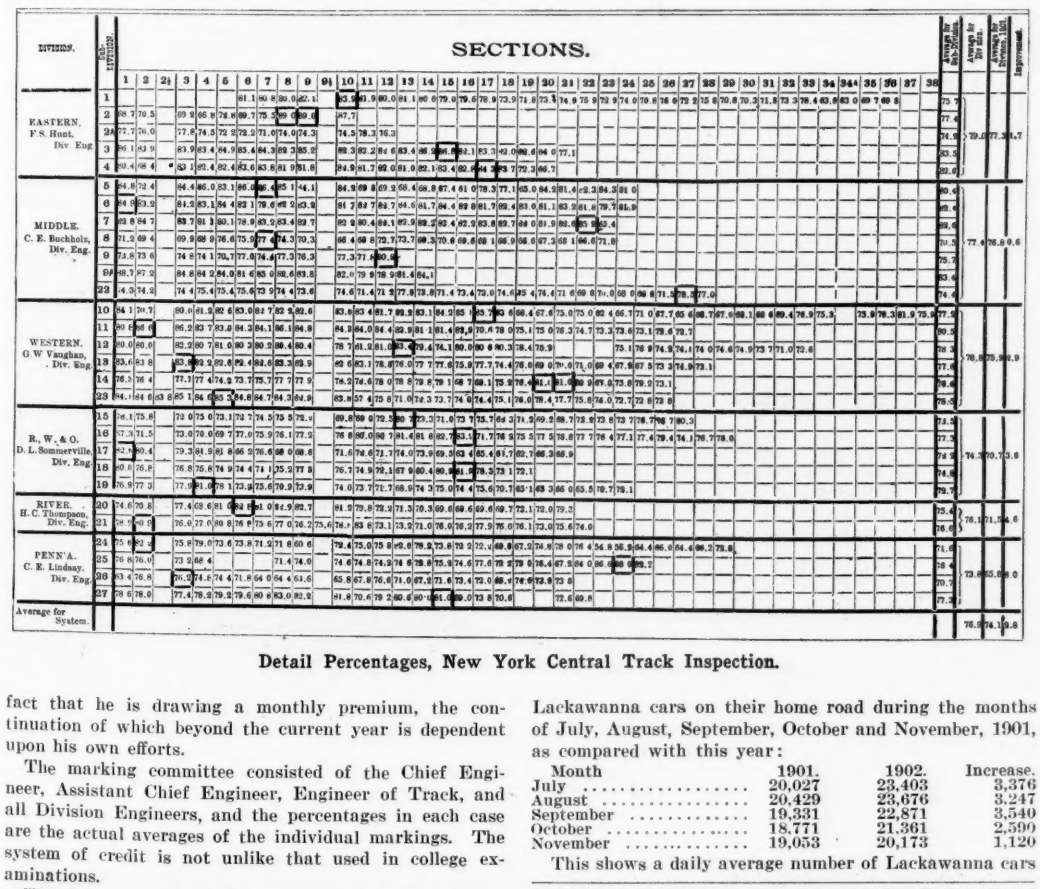
Premium System of Track Inspection on the New York Central.

The report of the fourth annual track inspection has just been issued, and the sheet of detail percentages is here reproduced (much reduced in scale). The particular feature of the system of premiums which differs from that in use on other large railroads is the distribution of the reward throughout the year, on the monthly pay roll, so that each month, when the supervisor or section foreman signs the roll, his attention is called to the fact that he is drawing a monthly premium, the continuation of which beyond the current year is dependent upon his own efforts.

The marking committee consisted of the Chief Engineer, Assistant Chief Engineer, Engineer of Track, and all Division Engineers, and the percentages in each case are the actual averages of the individual markings. The system of credit is not unlike that used in college examinations.

The first report in this form on the New York Central was made in 1899, and premiums for the best sections and sub-divisions were first awarded in 1900. Figures obtained in this way seem scarcely accurate enough to admit of a fixed comparison, year by year, though the averaging of the opinions of eight or ten judges tends to reduce greatly the personal equation. It is of interest, however, to note the steady increase in the standard of the line since the system was inaugurated, as shown in the table.

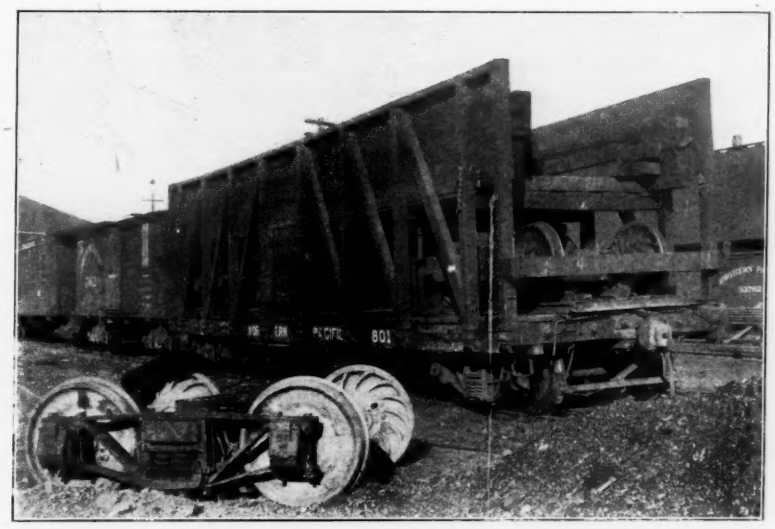
	1899.	1900.	1901.	1902.
Main line, New York to Buffalo..	78.7	80.7	81.9	83.2
All tracks	...	72.3	74.1	76.9



Detail Percentages, New York Central Track Inspection.

A Convenient Car for Wrecking Outfits.

A convenient form of wrecking outfit car designed by Mr. H. H. Warner, Division Master Mechanic of the Northern Pacific at South Tacoma, Wash., is shown in the accompanying engraving. On this one car are placed all of the supplies usually required at wrecks, except those carried in the derrick car.



A Convenient Car for Wrecking Outfits.

The car has two decks, on the lower of which are placed the trucks, fitted wheels, rails, bridge timbers, derrick projections, wheel skids, etc. The cross ties, blocking, etc., are put on the upper deck, while the locker contains rail spikes, fish plates, angle braces, track bolts and nuts, claw and lining bars, spike mauls, shovels, wrenches and other such tools and supplies. Concentrating these supplies on one car is found to be a great advantage.

The Operation of the Per Diem System of Settlement for Car Hire.*

Primarily, per diem is for the purpose of stimulating and accelerating the loading, forwarding and release of cars, and, when released, the return of foreign cars to owners. In this connection attention is called to the following statement showing the daily average number of Lackawanna cars on their home road during the months of July, August, September, October and November, 1901, as compared with this year:

Month	1901.	1902.	Increase.
July	20,027	23,403	3,376
August	20,429	23,676	3,247
September	19,331	22,871	3,540
October	18,771	21,361	2,590
November	19,053	20,173	1,120

This shows a daily average number of Lackawanna cars on its own line for the period mentioned in 1902 over and above that of the corresponding period of the year 1901 of 2,775 cars, equal to a daily average increase of 14⅕ per cent.

Notwithstanding the fact that for the period mentioned under per diem, there was a daily average of 2,775 less Lackawanna cars on foreign lines as compared with the same period in 1901, I find that business from lines having Lackawanna equipment has increased practically 20 per cent., demonstrating to my mind that the per diem system has generally impressed all concerned with the value of equipment, and that by reason of this better appreciation of value the fewest possible number of foreign cars have been ordered by the lines borrowing equipment consistent with taking care of the traffic offered properly and in the minimum amount of time.

One railroad that in previous years detained Lackawanna equipment in lots of 100 or more cars an average of upwards of 40 days per car this year orders equipment in groups of five cars each, none of our cars having as yet earned one day's penalty on that line. In reply to our urgent appeals we were continually advised that business for these particular cars would develop in a few days. I know of no reason for the change in method of handling foreign equipment by that road other than the operation of per diem.

The statement below shows the daily average number of foreign cars on the Lackawanna during the months of July, August, September, October and November, 1901, as compared with this year:

Month.	1901.	1902.	Decrease.
July	4,795	3,347	1,448
August	4,130	2,092	2,038
September	4,220	2,482	1,738
October	4,979	2,897	2,082
November	6,519	3,818	2,701

From this it will be seen that the average daily number of foreign cars on the Lackawanna for the same period in 1902 as against 1901 has decreased 2,001 cars, or about 44 per cent. This is due to three special reasons, as follows:

First. The railroads having Lackawanna equipment located the same and placed cars for loading home, thus minimizing their expense for car hire.

Second. The manufacturing industries on our line were forced, by reason of the coal strike, to reduce very materially their output, requiring correspondingly less material coming to us in foreign cars for their use.

Third. In previous years there was an immense demand for foreign cars at our Buffalo terminal in which to transfer coal for movement via western lines, for which there has been no demand up to Dec. 1, this year.

The decrease in the average detention per car of foreign cars on our rails is 1.6 days, or 27 per cent., as per the following statement:

Average Detention per Car.

July	6.4 days	4.4 days	2. days
August	5.1 "	3.4 "	1.7 "
September	5.9 "	4.3 "	1.6 "
October	5.6 "	4.3 "	1.3 "
November	6. "	4.6 "	1.4 "

This decrease, while not directly the result of per diem, is to a certain extent indirectly so for the reason that with the inauguration of per diem, car service [demurrage] received an impetus and support by all lines that enabled it to secure a much more prompt release of cars than heretofore. In addition to this, our increased facilities at large terminals have reduced delays by reason of being able to release more cars per day; further, the abolishing of intermediate train terminals, or, in other words, reducing the number of points at which trains stop for making up, etc., has correspondingly reduced the opportunities for delays, which in turn assists in decreasing the detention to foreign cars on our rails. The foregoing shows that during the operation of per diem the Lackawanna had a greater proportion of its own cars and a less number of foreign cars on its own road than under mileage settlements; thus owners are enabled to have a larger amount of their own equipment at their own command, which is very desirable at all times and which is the main object desired by the operation of this system.

The amount earned by foreign equipment on the Lackawanna for the months of July, August, September and October this year, is 2½ per cent. less than what we would have paid on the same equipment had we settled on the mileage basis. We are unable to furnish a like comparison regarding the earnings of Lackawanna cars on foreign roads, for the reason that the mileage has not been furnished us. However, notwithstanding that we had on foreign roads for the months of July to October, inclusive, of this year, 16¼ per cent. less Lackawanna cars than for the corresponding months of the previous year, our earnings for these cars are only 7 per cent. less.

Aside from the results shown, the justice of settlement of freight car hire for an agreed amount for each and every day a car is on a foreign line should appeal to every-

*Abstract of a paper presented to the New York Railroad Club, Dec. 19, 1902, by Mr. M. B. Casey, Superintendent of Car Service, D., L. & W.

one having the proper conception of property rights. The system has awakened the liveliest appreciation in all the departments of railroad work of the importance of the prompt handling of equipment and the money vaule incident thereto; in a general way it has resulted in closer relationship between the car service officer and the other departments, *first*, with officers in charge of freight traffic, relative to the application of Per Diem Rule No. 5 regarding reclaims on switching service; *second*, with the car department in regard to the application of Rules 7 and 8 regarding exemptions from per diem owing to disabled cars, etc., and in like manner with all other departments—which is decidedly beneficial to the car service officer, such association broadening his views.

Taking the proposition in its entirety we can but be impressed with the successful manner in which it has been applied, more particularly in view of the many obstacles that it was anticipated would be encountered before its success could be assured. There is a prevailing impression that some few of the rules might be modified or changed for the betterment of the service, possibly in the elimination of Rule No. 5 regarding reclaim and the adjustment of a switching charge so as to protect the switching lines to the extent that reclaim now does. Perhaps a penalty for the diversion of cars would be beneficial. Again, there are some who feel that Rule No. 3 could be changed so as to waive the necessity for penalty notices, establishing instead an automatic penalty to be applied in the absence of advice from the owner to the contrary.

A Thread Milling Machine.

The production of screws, which shall vary within less than appreciable limits of error, is probably one of the most difficult problems which come up in machine shop practice. The machine illustrated herewith is designed for the manufacture of precision screws, worms, lead and feed screws, and spiral gears for high-grade machine tools.

The bed and pan are made in a single casting, thereby greatly increasing the stiffness of the former without increasing the weight of the machine as a whole. Two sizes—differing only in length of bed—are regularly made. The beds of these are 3 ft. 6 in. and 9 ft. long, with capacity for threading screws, 14 in. and 80 in. long, respectively. The maximum diameter of screws threaded or spiral gears that can be cut on each, is 6 in.

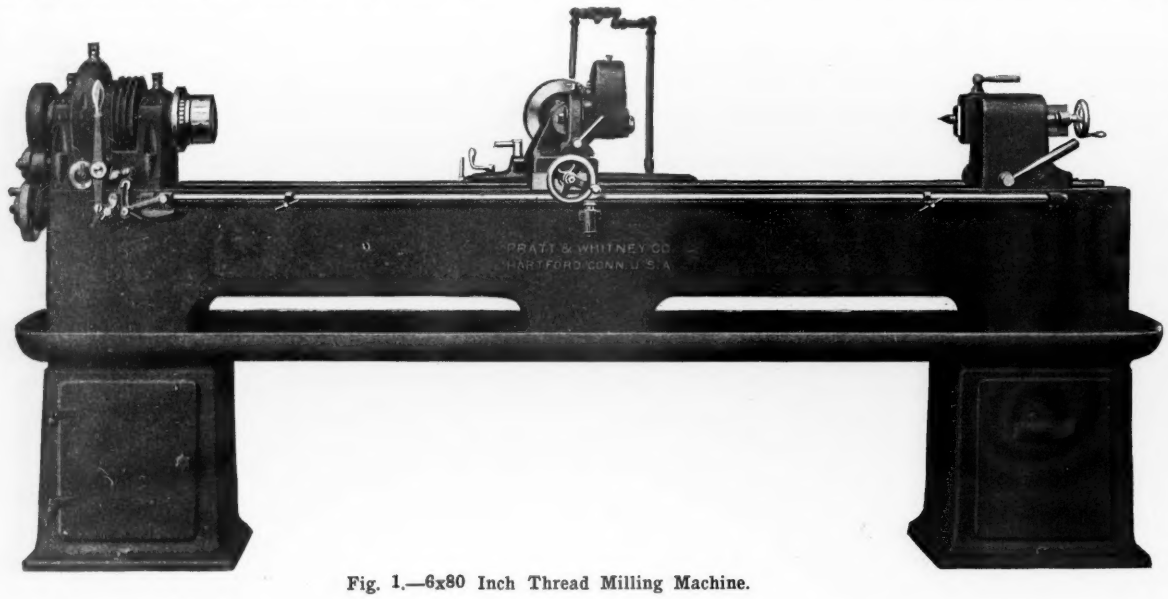


Fig. 1.—6x80 Inch Thread Milling Machine.

The head and tail-stock are carried on a single *V* at the rear and a flat track at the front of the machine. The carriage *K* (see reference key Fig. 2) rests on a flat track at both front and rear of the machine, is gibbed in a narrow angular slide at the rear, and the bearing in this slide is long, entirely overcoming any tendency of the carriage to tip or cramp. Lifting of the carriage by the upward thrust of the cutter is prevented by a long flat gib underneath the flat track at the front of the machine. The lead-screw *J* is in the center of the angular carriage slide. By this construction great accuracy of movement of the carriage is secured, yet permitting the carriage to be moved with the greatest ease.

The milling cutter arbor is mounted in a head *T* connected to the cross slide *L* on the carriage *K* by trunnions, which allow it to be tilted to any required angle for a given pitch of thread. The center of the cutter *U* is in the same horizontal plane as the center line of the screw to be cut, and in the same vertical plane as the center line through the trunnions. Thus, no matter through what angle the cutter may be turned, the point of the cutting tooth is always level with the center line of the work. To provide means for setting the cutter properly for any given thread, one of the trunnions is graduated and a table of angles is furnished giving the position of the cutter head for all standard pitches.

Provision for making the cut the correct depth for a given thread or gear is made by a micrometer head *S* on the cross slide screw. After placing the work in the machine, the cutter is brought forward by the cross slide screw till a tooth of the cutter just touches the work, and the micrometer is set to zero; the carriage is moved along the bed till the tooth clears the end of the work, the cutter is brought forward by the micrometer cross feed screw to the correct depth and the cross slide clamped in this position. Then with the proper change gears in place for the required pitch, and the stop N_1 (assuming the cut to be made towards the head stock) set for knock-off of feed at the required point, the machine is ready for operation and needs no further attention beyond removing the finished piece and replacing it with a new blank.

The carriage *K* can be moved along the bed independently of the change gears by turning the small crank *P* at the back of the carriage, which crank, through a worm gear, revolves the lead-screw nut. Thus it is easy to set the cutter to begin the thread at any desired point, or to re-set the cutter in its proper place. The nut is locked in position by the lever *Q* at the end of the carriage, independently of the worm above mentioned, so no movement of the carriage can take place except from the lead-screw.

The machine is regularly equipped with English lead-screw having 6 threads per in. and change gears for cutting threads from 20 per in. to threads of 4-in. pitch. It is built, to order, with metric lead-screw of 4 mm. pitch, or either English or metric screw with translating gears to enable metric threads to be cut with English screw, or vice versa.

The travel of the carriage is controlled by the lever *M* on the front of the head-stock. With this lever in its central position, vertical, the feed is thrown out; when pushed to the left the feed is thrown in; and when to the right the carriage is returned to the initial end of the cut. This latter movement is at relatively fast speed, being driven by a belt on the grooved pulley *G*. During the cutting operation the pulley *G* runs loose on the spindle.

When screws of 2-in. lead or upward (or corresponding spiral gears) are to be cut, it is preferable to drive directly on the lead-screw, rather than on the spindle. This change in drive is made by slacking the capstan-screw in the link O_2, allowing the link to swing downward till it locks the lower end of the lever *M* in place, as it will do, and pushing in a knob at the end of the driving cone spindle.

Indexing for multiple thread and spiral gear cutting is a very simple operation on this machine. A compound spindle, consisting of an outer hollow spindle which carries the driving mechanism and the spindle gear, and an inner hollow spindle carrying the nose-piece and collet, is used; the inner spindle carries a notched index ring *H*, and the outer spindle a pawl which normally locks the two spindles together.

Six round belts are used for driving the cutter, in place of the ordinary flat belt. These belts are equal to a 3½-in. flat belt, and have such an excess of driving power, over that required for the work, that any two may be broken without affecting the operation of the cutter. This is an important feature, as should the cutter driving belt fail entirely, as a single flat belt would do, if it failed at all, the cutter and the work would both be damaged before the machine could be stopped. The cutter driving pulley is shown at *V* in the reference key.

Ample provision for varying the rotative speed of the work is made. The grooved cone pulley has six steps, and as the belt will drive successfully on the step next below that directly corresponding to the step on the driving cone, and vice versa, 16 changes on the round belt cones alone are available; these, combined with the two changes on the countershaft, and the two other changes possible on the two-grade friction cone on which the main driving belt runs, make 64 changes of speed available, when driving on the spindle, and a similar number when driving on the lead-screw, which cover all requirements from fine threads on screws of say ⅜ of an in. diameter to spiral gears of 6 in. diameter.

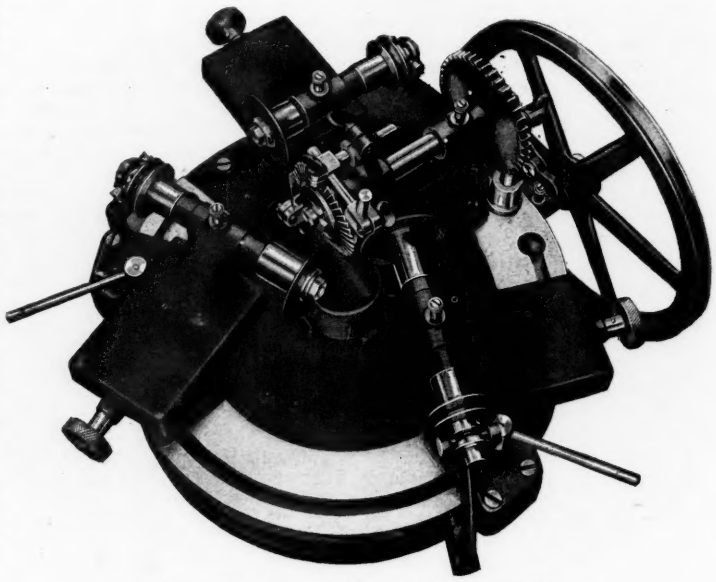


Fig. 4.—Top View of Automatic Cutter Grinder.

The form of milling cutter used on this machine in milling threads is that shown in the engraving herewith, Fig. 3. In this cutter the teeth are staggered, that is, each tooth, with the exception of a single one, has but one cutting edge, these cutting edges alternating in successive teeth. One is left a full tooth for the purpose of gaging. It is claimed that these cutters can be run 25 to 30 hours on ordinary work without regrinding.

The smaller size of this machine has a column base with cabinet for tools and change gears, and oil tank. The larger size has a cabinet leg under the head-stock and oil tank in a box leg under the tail-stock. Very thorough provision for straining the oil is made. The oil pump is on the back of the machine.

For grinding the cutters (see Fig. 4) the cutter is mounted on an arbor supported above a circular base, and mounted on this base are three adjustable grinding heads. Two of these grinding heads may be set at any desired angle to the cutter arbor by graduations on the base, and are used for grinding the angular sides of the cutter. The third grinding head is parallel to the cutter arbor, and is used for grinding the ends of the teeth.

The spindles of each of the grinding heads have a reciprocating motion when at work, slightly greater than the longest face of the cutter they will be called upon to grind, and the full length of each cutting edge is traversed twice by the wheel. The reciprocating movements of the spindles which are at an angle with the cutter arbor, alternate with each other so that interference of the two wheels is impossible. All the grinding heads are adjustable on the circular head of the machine to provide for the variation in sizes of cutter used.

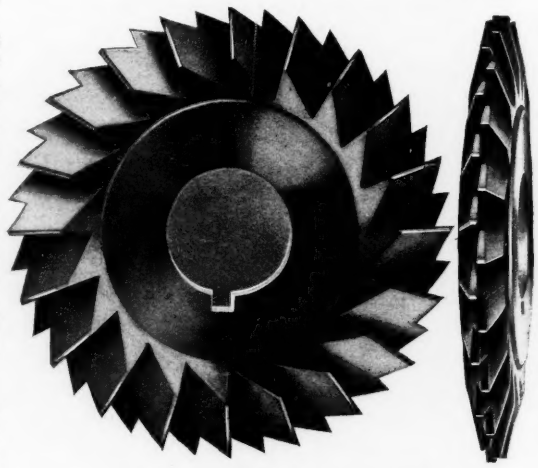


Fig. 3.—Thread Milling Cutter.

In the grinding operation the cutter is automatically indexed after each two passes of the wheel over the edge being ground. Thus the machine needs no attention after the cutter is placed on its arbor and the grinding heads adjusted to bring the wheels to the proper position for

grinding the cutter in place. The machine is made by the Pratt & Whitney Co., Hartford, Conn.

Underground Telegraph Lines.

[*Extract from a letter from Mr. Arthur H. Johnson, London.*]

The British post office authorities are gradually completing an underground telegraph cable, including a number of separate circuits, from London to Liverpool, Glasgow and Edinburgh. They have already some of the sections in working order and the cast-iron pipes are laid practically over the whole route.

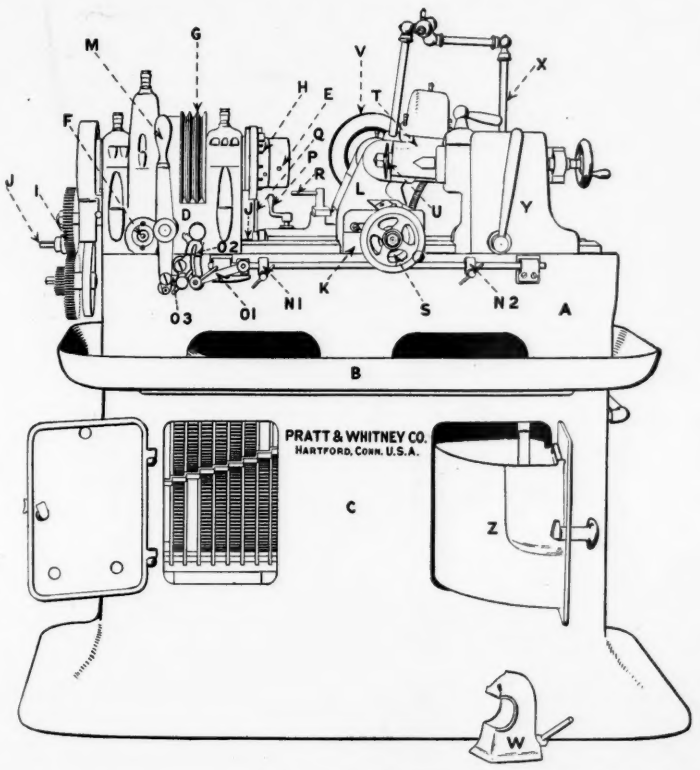
The operation of underground telegraphs for long distances has become practicable owing to the invention of what is technically known as the "dry-core" cable. The difficulties formerly contended with may be classified under two heads, namely, (1) huge expense and comparatively short life of gutta-percha insulation for *long lengths*, and second, the high "capacity" of a gutta-percha-insulated wire when laid in the ground. The speed of working a telegraph line is governed by what is technically known as the "K. R.," i.e., capacity × resistance. Capacity is less as a wire is isolated from other masses of material, consequently an ærial wire has about the least possible capacity.

Capacity may be likened to hydraulics in this sense that supposing one has a long pipe and wishes to deliver power at the end, it is first necessary to fill the pipe before it will transmit and deliver force at the further end. The analogy is far from complete, but this gives the idea.

A dry core cable consists of bare copper wires loosely wrapped with manilla paper so as to insulate one from the other. The insulation thus consists partly of paper (which *when dry* offers a very high resistance to the passage of an electric current), and partly of the air, filling the interstices of the loosely assembled paper and wires. It is, of course, absolutely necessary to exclude even a trace of moisture. This is effected by covering the cable with a sheath of lead. Ordinary "wiped" plumbers' joints are used where one length of cable joins another, say every quarter of a mile, and at these points a screw nipple is so fixed that the air-tightness of the cable may be tested by air pressure up to say 30 lbs. to the inch. Also, if by accident the cable should happen to get slightly damaged the air pump is used to dry the paper, precaution being taken to pass the air through a desiccator (consisting of bags containing chloride of calcium) which thoroughly dries the air before admission to the cable.

It is not contemplated at present to rely upon underground cables for anything but emergency working, i.e., when overhead lines are down. They are not suitable for long distance telephone work owing to their high capacity compared with an ærial line, nor are they suitable for high speed telegraph transmission, which in England is usually done by the Wheatstone automatic, an instrument whose average capacity is about 400 words a minute, but which at a pinch and on a suitable line can transmit and print 600 words a minute.

I am just completing some miles of a 38-wire dry core cable for the London & South Western Railway from Waterloo Station towards Clapham Junction, where it is practically impossible to erect poles.



A Bed.
B Pan.
C Cabinet base.
D Head-stock.
E Spindle nose-piece.
F End of shaft of cone driving pulley.
G Spindle pulley for reversing travel of carriage.
H Index ring.
I Change gears.
J Lead-screw.
K Carriage.
L Cross slide.
M Feed-controlling lever.
N1, N2 Adjustable carriage stops.
O1, O2, O3 Links connecting stop mechanism and feed-controlling lever, and for changing relative directions of fast and slow speeds of carriage travel.
P Crank for turning lead-screw nut in carriage.
Q Lever for locking lead-screw nut in carriage.
R Lever for clamping carriage to cross slide.
S Micrometer for setting cutter to depth of thread of gear tooth.
T Milling cutter head.
U Milling cutter.
V Milling cutter driving pulley.
W Back-rest.
X Oil-piping.
Y Tail-stock.
Z Oil tank.

Fig. 2.—Thread Milling Machine and Reference Key.

The Railroads of Rhodesia.

Another section of through-route Rhodesian railroad has been completed, and the news raises the whole question of what has recently been done in construction in the country. It is now some years since the Cape to Bulawayo Railway was finished, and a period of pause elapsed as to future railroad policy. At the time there was the great gap between Bulawayo and Umtali. Then, as matters stood, from Umtali [Portuguese frontier] to Beira the section of completed railroad, though useful for bringing goods by east route to the borders of Rhodesia, left much to be desired in the direction of supply of transport facilities for mining districts in Mashonaland, Sebakwe, and Selukwe. A little over three years ago the railroad was carried on from Umtali to Salisbury, and work was being pressed on in 1899 for the making of the whole of the system from Beira to Salisbury of uniform (broad) gage with the general system. About that time, too, the policy was decided upon of connecting up the links so as to fill the gap between Bulawayo and Salisbury. In June, 1902, the extension from Beira via Salisbury was carried as far as Gwelo, and opened for traffic. This week news is received that the further extension from Gwelo to Bulawayo has been opened (Dec. 1, 1902) for traffic. All the links, therefore, are now finished, and there is a through line from the Cape to Beira.

From Beira to Salisbury is approximately 400 miles. From Salisbury to Bulawayo is another 300 miles. The connecting up of the systems means that Rhodesia now has direct railroad access to the outside world both by the eastern port of Beira and from the southern Cape ports. Now that the Salisbury-Bulawayo sections are finished there will be renewed energy in pushing on the Gwanda line, of which about half the total of 100 miles in length is graded.

There is another line under construction of very great significance to the mining industry and to Rhodesia at large. It is the extension northward from Bulawayo. In its course from Bulawayo to the Victoria Falls, on the Zambesi River, this new line will pass through the Wankie coal field, containing coal represented to be of pretty well equal quality to Cardiff coal, and the area being developed for coal has indicated an immense tonnage that will be available for shipment. The Wankie coal area is about 204 miles distant from Bulawayo, and the railroad for pretty well two-thirds of that distance has been completed, so far as the contractors' running accommodation is concerned. The public running of the line to the coal fields is expected to be effected by about April next. Then a further distance of about 80 miles northwest of the Wankie field to the River Zambesi will be constructed, and probably completed by the end of the year. There a halt might be expected; but it is not intended, for, pending the construction of a steel cantilever bridge across the Zambesi, the plant for railroad construction north of the Zambesi will be passed over the river, either by being floated across or in part by temporary ærial tramway. It is contemplated to push on work so that railroad accommodation can be afforded to the Kafue district, about which so much has lately been heard in the matter of rich discoveries of copper, lead and zinc on territory belonging to the Northern Copper and the Rhodesia Copper Companies. By the time the northern section of the railroad is graded and ready the bridge should be finished.

In regard to the Wankie coal region, hopes are entertained that there will be an output of coal available for the mine districts of from 300 tons to 500 tons a day, to be increased in course of time.

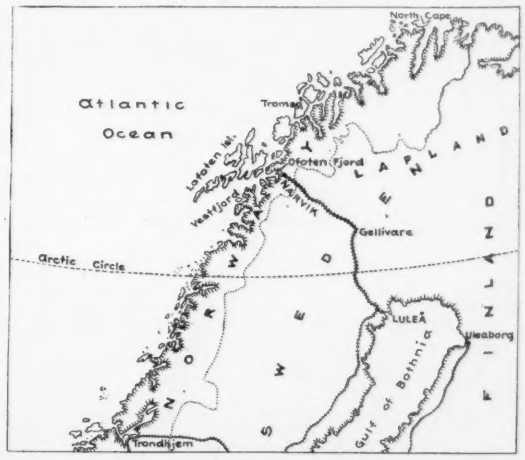
The Rhodesia Copper Company, which acquired rights over 450 square miles from the Northern Copper Company, as above explained, beyond developments in respect of copper deposits, has made some important discoveries of large and rich bodies of lead and zinc ore.

In the matter of railroad construction in Rhodesia, those who direct the affairs of the country deserve high praise for energy and the overcoming of difficulties. Notwithstanding all the troubles that the country has passed through in recent years, we have witnessed the rapidity of the construction of the Vryburg to Bulawayo section, the comprehensive straightening of line and broadening of gage of the Beira section, rapid construction of the links between Salisbury and Bulawayo (albeit partly at the expense of the Gwanda section), the quick completion of the Ayrshire line, and the important and rapid work done in pushing on so as to obtain a railroad giving access to the richest coal property as yet reported upon as existent in Rhodesia. The policy undoubtedly is a right one. The country now has the trunk railroads it urgently required, for transport has been one of the main difficulties of the past.—*The Statist.*

The Ofoten Railroad—Norway.

The Dagsposten, published at Trondhjem, Norway, gives the following account of this line, which was opened for through traffic in November, and is interesting not only because it connects the head waters of the Gulf of Bothnia with the Norwegian coast line at a far higher latitude than any similar project, but because it is the most northern railroad in the world. For a further account of the Swedish portion of the line, see our issue of Sept. 19, page 725.

In June, 1883, a concession was given to a Swedish company to build the Norwegian part of a railroad projected from the Ofoten Fjord, at the head of the great Vest Fjord, on the Coast of Norway, to Lulea, on the Gulf of Bothnia, but after a few years of desultory work the project was abandoned, for financial reasons. The



Ofoten and Norrland Railroads.

grade completed at that time was, in 1892, sold to the government, but nothing further was done until 1896. Another effort was then made by a company which proposed to guarantee to the government satisfactory dividends from the transportation of ore if the government would build the road—an arrangement exactly the reverse of the usual form of negotiations in such cases. As a result of this, investigations were made in the summer of 1897; a map was drawn of the surroundings of Narvik, or Victoriahavn, the terminus on Ofoten Fjord, and in 1898 the Norwegian Parliament voted to build the road, at government expense.

Actual work was begun in the fall of 1898, at the coast end, and connection with the Swedish Norrland Railroad, which had previously been in operation for about two-thirds of its present length, was made at the frontier three years and a half later.

After leaving the terminus at Narvik and running for a short distance past the ore docks, the "Romsdalsbakfjord" mountains are ascended at a sharp grade, and then, after a culvert crossing of the Hundals River, the road enters the rugged North Valley. This is characteristic Norwegian hill country, and the engineering difficulties were exceedingly great. A portion of the valley is crossed by a nine-span bridge, 591 ft. long and 128 ft. above the ravine, at its highest point. The westerly approach to the bridge is through a tunnel about 1,600 ft. long, and at the east end, on the way to the frontier, there is another tunnel of nearly 1,000 ft. At the end of the North Valley the road is practically at the summit of the mountains, 1,704 ft. above sea level, and runs nearly level to the frontier, approximately 70 miles from Narvik.

In this distance there are 20 tunnels, aggregating over two and a half miles, and a number of lesser crossings, besides the long bridge in the North Valley.

Work is now in progress on the ore dock at Narvik, which will be nearly a thousand feet long, and built in modern shape, with large storage bins. The railroad is the sole means of access to the Norbotten district of Sweden, which produces a considerable amount of ore annually, and is capable of large development with the new transportation facilities to the coast.

The Hungarian State Railroads have made a general advance in freight rates in this way: There is a tax of 7 per cent. on express freight and of 5 per cent. on ordinary freight collected by the railroads and paid to the State. The railroads have heretofore included the tax in the rates, or assumed the tax themselves, as it were. Hereafter the tax will be collected in addition to the old rates. The addition to the receipts thereby is estimated at $1,000,000.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

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Car and Locomotive Output During 1902.—Returns received direct from practically every locomotive and car building plant in the country show that approximately 164,547 cars have been built, including cars for use on elevated railroads, but exclusive of street and other electric cars. This is considerably the largest record which has ever been made in the country and exceeds by 25,542 the output for 1901. These figures, of course, do not include cars built by railroads at their own shops. Of the cars recorded, approximately 162,599 are for freight service, and 1,948 for passenger service, 161,747 are for domestic use, and 2,800 are for export. Last year the total number of cars built was 144,267, which exceeded by 20,161 the recorded output for the year 1900. The 1901 figures included also 5,262 street cars. Almost all of the figures for both 1902 and 1901 are official, and in the two or three cases where it was necessary to make an estimate, the number of cars involved was small, and we were enabled to make a close calculation from our own current records, so that the sum total, as here given, may be accepted as being very nearly correct. The proportion of steel cars and cars with steel underframes to wooden cars, will be published in a subsequent issue. It may be interesting also to note that 5,561 cars were built during the year by three firms in Canada.

During the year 4,070 locomotives were built at the various locomotive plants in the country, as against 3,384 last year. This figure is official throughout and required no estimating. The number for the current year includes 74 electric locomotives. The real meaning of this figure is perhaps best realized by calculating the expenditure involved, which would be nearly $48,000,000, if the average cost per locomotive is assumed to be $12,000.

The "Train Board"—the arrangement by which a superintendent, with lettered blocks, movable on a big chart fixed to the wall of his office, keeps a graphic record of his train movements—is to be used on the main line of the Gulf, Colorado & Santa Fe for all freight trains; not for fast trains alone. This line, from Purcell, Ind. T., to Galveston, Tex., is 518 miles long, and General Manager Nixon, in whose office the board is to be kept, estimates that the number of trains to be kept track of daily will be fifty. The addition to the work of the telegraph department will be considerable, but, on the other hand, it is expected that a marked reduction can be made in the number of messages sent by the car service department and the traffic department in the nature of tracers for single cars or shipments. Officers of these departments will now be able to get their information direct from the general manager's office, in the same building, and the use of the wires for a multitude of inquiries will be unnecessary. The principal reason why it was decided to have all freight trains represented on the board was that the distinction between fast freight and slow freight has come to be hard to define. Where competition is keen nearly all kinds of freight have to be treated as fast, and there is, consequently, the need of keeping a close watch of it from the head office.

Street car conductors ought to know the significance of a tail-light on a freight train, and a freight train, short or long, ought not to be run across a street without a tail signal. This is a lesson which is taught every now and then by a collision at a street crossing, but which does not seem to stick. The last occasion was at Weehawken, N. J., last Friday night about 12 o'clock, where a street car of the Union Hill line was overturned by the rear part of a freight train, which had broken away from the forward part, and the whole of the sixty persons in the car were injured, though the injuries of all but three were slight. The freight had only nine cars altogether and three broke away. The street car men thought the sixth car was the last. Nothing is said in the reports about the crossing watchman or whether there was one. This, however, does not affect the main question, for, unfortunately, crossing watchmen sometimes forget to look for tail-lights, so that anyone in charge of a street car needs to look out for himself. Yard conductors will say, doubtless, that to require the use of red lights in yard movements is nothing but red tape; but a street crossing is an exceedingly dangerous place, justifying some red tape. A second lesson of an occurrence of this kind is that concerning the value of the automatic air-brake. This also is useful in short-distance movements as well as long-disance. If the air had been coupled up and in use on the whole of the nine cars the break-in-two would have detected itself and no collision would have occurred.

The retiring General Manager of the Pennsylvania Railroad is an engineer. Of his 40 years of service about 36 per cent. has been spent in the engineering department. The new General Manager is also an engineer, and up to this time all of his work has been in the mechanical department. If we look over the list of general officers of the Pennsylvania Railroad, from the President down and through the list of division operating officers, we shall find that the engineers predominate greatly. The same thing is becoming true in the Baltimore & Ohio. The President and many of the general and division officers are engineers. If we look through the lists of other railroad companies, we shall find the engineers becoming constantly more numerous in the general offices and in the transportation department. It is not likely that all this has come about as a matter of doctrine. It is not likely that anybody has said that "engineers are fittest for the executive work of railroads, therefore, we will go amongst the engineers for our officers." Men are picked out and advanced because they can do the work and not because they have had some one kind of education. All of this must be encouraging to the youngsters who are now grinding away at the formidable Christmas examinations in the engineering schools. Just at this moment life seems to a good many of them hardly worth living, but it will be a little more cheerful if they recognize that they are preparing to be the general officers and the division officers of the railroads and of the great industrial concerns. They may take still another lesson from recent events. The new General Manager of the Pennsylvania Railroad is only 37 years old, the President of the Baltimore & Ohio is only 44, and was General Manager of the Pennsylvania Lines at 38. If the boys will examine the railroad lists, they will see that the average age of the important officers is constantly declining, and the same thing is true in industrial life; the moral of which is that the young men should get their claws in good and deep in the first 10 years of their active work.

Possible Fire Damage to the Brooklyn Bridge.

The fire on the top of the west pier of the New East River bridge has revived the discussion of the danger to the old Brooklyn Bridge in case of the burning of the buildings beneath the approaches. A contemporary tells us that an officer of the navy has recently said that should the buildings on either side of the river under the Brooklyn Bridge be burned, the bridge would almost certainly fall. His reason is that the tensile strength of steel falls fast under high temperature.

We do not deny that a fire under the bridge would be uncomfortable, even if not alarming, and might do considerable damage to the structure. But the danger is considerably overestimated when it is assumed that the bridge would fall.

All the buildings beneath the bridge and eighty feet on each side have been reduced to three stories, with roofs of arched brickwork. The lowest member on the bridge is forty-five feet above the highest building, and the cables are for the most part still farther away. At about eighty feet from the anchorages the cables pass below the roadway, and finally enter the stone work about seventy-eight feet above the ground. Beneath this portion of each cable there are no buildings.

It is well nigh impossible for flames from any of these buildings to reach the cables and heat them sufficiently to alter their tensile strength. Of course, flying brands might fall on the woodwork of the bridge, but, with the present fire protection, they could be easily extinguished.

But even making for a moment the impossible assumption that the cables were overheated and annealed throughout, it can be shown that the factor of safety is about two. The ultimate strength of the wires in the 14½-in. cables, is 170,000 lbs. per sq. in., and the yield point is over 140,000 lbs. The wires are made of 62 carbon steel, which, when annealed has an ultimate strength of about 86,000 lbs. per sq. in. and a yield point of 60,000 lbs. The actual dead load stress in the cables is but 33,600 lbs. per sq. in., which as before stated leaves a factor of safety of nearly two. Even with the maximum live load the stress only rises to 40,400 lbs., which is still below the danger point.

Tests of the wires in the cables of the New East River bridge since the fire are said to have shown that strands in the outer layer were damaged about 50 per cent. In the second layer the diminution in strength was 25 per cent., while in the third layer it was less than 10 per cent. In the light of these tests it would be rather hard to prove that the cables of the Brooklyn Bridge could be damaged throughout.

The East River fire has inflamed a number of minds, but the temperature is falling fast, and they will soon get back to the normal.

The Power to Make Rates.

The Interstate Commerce Commissioners renew their annual request for more power, which, summed up, is a request for power to make rates; their reasoning always comes around to that. They inform us that the main purpose of the law was to prevent unreasonable charges and undue discrimination. They say that it has furnished a considerable restraint upon the carriers, but "a sense of the wrongs and injustice which cannot be prevented in the present state of law' impels the Commissioners to ask again for more power.

According to their own statement, properly interpreted, these wrongs and injustices seem to be in a fair way to disappear, so far as wrong and injustice may disappear in a world inhabited by erring men, for one of their own points of argument is "the rapid disappearance of railway competition and the maintenance of rates established by combination," all of which seems to them an "increasingly grave" matter. But most of us long ago agreed, and, if we are not mistaken, the Commissioners themselves have agreed, that the chief source of wrongs and injustices has been in unrestrained competition, which the Commissioners find is rapidly disappearing.

They furnish a concrete example of the difficulties under which they are working with their present limited powers. Investigations undertaken in December of 1901 and January of 1902 showed that rates on grain and packing house products were "in a most demoralized condition," but as it is a criminal offence to give secret rates, the Commission referred the evidence which it had accumulated to the Attorney General and employed an attorney to assist in the criminal prosecution of the case, "but no convictions have yet been obtained, nor so far as the Commission knows have any indictments been found." What is the trouble?

The first impression of a hasty man is that this illustrates not a defect of the Interstate Commerce law but one of its best points. The Commission collected its evidence and set in motion the proper legal machinery of the Government. The Attorney General's office failed to find indictments. We naturally assume that the evidence collected did not justify indictments, at least that the highest law officer of the nation found it insufficient. What better arrangement could we want than such a check upon hasty and immature action? If the Attorney Gen-

eral fails to agree with the Commissioners, must we create a new court and vest the five Interstate Commerce Commissioners with the power to indict, to try and to punish? The people of the United States make mistakes, but they have an abiding common sense. They inherit political sagacity and have a racial sense of justice. We do not fear for a moment that they would ever consent to the creation of such a court.

But this case goes still further. As the Commissioners believed that no help could be hoped for from criminal proceedings, they appealed to Federal courts, asking that the railroads be compelled to observe their published schedules. A restraining order or preliminary injunction was granted, "and the Commission believes that these railroads have obeyed in the main the injunctions and that published rates have been exacted." So far, the machine is working very satisfactorily and just as it was designed to work, but the Commission concludes that the effect of these injunctions has been to materially advance rates received by carriers and paid by shippers. This is held to be no argument against injunctions, for it is conceded that the carriers should publish and maintain their rates, but it does show "that there ought to be some power which can not only compel these carriers to maintain the published rates, but which can compel them to publish a fair and reasonable rate." And so we come around to the original proposition that the Interstate Commerce Commission shall be endowed with power to make rates.

We do not believe that the people of the United States will ever consent to this any more than they will consent to giving that Commission power to indict, try and punish. Of course, the experiments will be tried and worked out in a few States; that is one of the blessed provisions of our Federal system. The fathers of the nation did a better job of nation building than they themselves realized. The individual States furnish so many working laboratories or experiment stations in which new things can be tried, and if the experiments fail, the harm done is mostly confined within the borders of the States within which the trial is made. The rest of us can sit by and watch and learn. This process is constantly going on to the great advantage of the nation at large. Wisconsin, Texas, Kansas and Nebraska have all furnished us with fine demonstrations in comparative sociology, as, indeed, have other States. And amongst the most valuable experiments which have been made, or which are now going on, are experiments in rate making and other railroad control, and the lessons of these experiments will gradually become plain.

Let us consider a little further this proposition to put the rate making power in the hands of the Commission. It seems quite within reasonable limits to say that no other body of men in the country would have such power over the fortunes and happiness of the people. They would be able to affect seriously the prices of commodities, in all parts of the land. They would have the power to destroy or build up industries, lines of trade, and communities. They would have the power to do this under the guidance of their own knowledge and judgment. They could do it arbitrarily as a simple matter of doctrine. It might be said that the railroads now have this power and that they act selfishly. In fact, they have not the power. They are restrained by actual commercial conditions, not by theories. They must foster trade and industries. They must cherish the interests of the regions which they serve and from which they draw their tonnage. They must please their patrons and the people at large. All of these things are understood better now than ever before. These conditions have always governed rates, but they govern them now more than at any former period in our railroad history and must control more and more as intelligence grows. The officers of the railroads are growing in their ideas of political economy, just as other people are.

But if, after all, we should decide to put the rate-making power in the hands of some branch of the Government, the Interstate Commissioners or the State Commissioners are not the bodies to be entrusted with that power. In the nature of things they cannot be. The Interstate Commerce Commission has always been, since April, 1887, an honorable, an able and a public-spirited body. Not a suggestion of impropriety of conduct has ever been brought against it that we have heard. Mr. Cleveland set a high standard, and it is to the credit of his successors in office that they have held up to that standard. But Mr. Bryan might have been elected President. A socialist may yet be elected. In one Presidential term the character of the Commission can be changed completely. We shall not try to forecast the work of a Bryanite commission; the reader can do that just as well as we can—probably better.

We may stop far short of a commission of socialists and still have a body not fit to be entrusted with this vast power. There has never been a railroad man on the Commission. Judge Cooley and Colonel Walker came nearest to it, but almost all of Colonel Walker's detail knowledge of railroad matters came after he left the Commission—at least, after his appointment. Nearly all of the Commissioners have been lawyers, with but little knowledge of railroad matters. In some instances they have been appointed for other reasons than special fitness for the work, probably in most cases. The pay is only $7,500 a year, and Washington is an expensive town to live in. What is the chance, under such conditions, of getting men who have the intellectual power, the force of character and the training in serious affairs that would put them in the rank of general managers? Obviously they could not be drawn from amongst railroad officers, or from the class of great merchants, or from the great manufacturers and traders. As the law now stands it is impossible that the Commission should come anywhere near the grade of a rate-making body. In fact the Supreme Court of the United States is the only body that we should think of trusting with a duty so important. Even the Supreme Court would fail in the end, and put the job back where it always has been and in end always must be, in the hands of the population of the earth. For prices must grow out of a thousand conditions that no group of men, not even Congress, can control.

A recent census bulletin contains a report on metal-working machinery. The term as used in the bulletin is understood to embrace "power operated machines for working metals in the form of bars, rods, wire, plates, sheets or castings, excluding such machinery as is used in the production of the metals themselves." It is found that in the year 1900 there were in the United States 397 establishments making metal-working machinery. The total capital was $54,294,000, the wages paid amounted to $15,217,000, and the value of the product was $44,385,000. The men employed numbered 29,436. Perhaps it will be surprising to most of our readers to know that the State of Ohio leads all the other States of the union in this industry. In that State there were found 68 establishments with a total capital of over 11 millions and a total product of over 10 millions. Next in order came Pennsylvania with a very little more money invested but with about three millions less product. The number of establishments was less than half as many as in Ohio, but that is a figure of little significance. Next in order comes Connecticut, with eight and one-third millions invested and five and two-thirds millions product. Then follow Massachusetts and New York.

NEW PUBLICATIONS.

The Design of Simple Roof-Trusses in Wood and Steel. With an introduction to the elements of graphic statics. By Malverd A. Howe, C.E., M. Am. Soc. C. E., Professor of Civil Engineering Rose Polytechnic Institute. 8 vo., x + 129 pages, 67 figures, 3 folding plates, 17 tables. Index. New York: John Wiley & Sons. London. Chapman & Hall, Limited, 1902. $2.00.

Professor Howe does not claim originality for his little book, he only claims convenience, and, surely, that modest claim will be allowed. The special material which he has collected is scattered in various treatises, many of them costly, and he has aimed to bring together in a small compass all the essentials required in properly designing ordinary roof trusses. His own experience in giving a short but somewhat comprehensive course in roof design to all the students of the junior year at the Rose Polytechnic Institute has compelled him to collect the data which he now publishes in book form. The various chapters cover general principles, the properties of beams and trusses, the strength of materials, the design of roof trusses in general and special points in the design of wooden and of steel roof trusses. The chapter on wooden roof trusses is the longest one in the book, and is particularly full in details of connections.

Stereotomy. By Arthur W. French, C.E., Professor of Civil Engineering, Worcester Polytechnic Institute; Assoc. M. Am. Soc. C. E., and Howard C. Ives, C.E., Instructor in Civil Engineering, Worcester Polytechnic Institute; Jun. Am. Soc. C. E. 8 vo. x + 119 pages, 47 figures and 22 folding plates. New York: John Wiley & Sons. London: Chapman & Hall, Limited, 1902. $2.50.

To those of us who learned what little we know of descriptive geometry and mechanical drawing in those ancient times when text books and methods were still largely affected by the traditions of West Point this little book on stereotomy has the face of an old friend. We find the skew arch laid out on the helicoidal method, and the logarithmic method, and all the rest of them, and we find that despised short-cut known as the false skew arch, or, as we called it, the bastard skew. We find the five-centered oval and the groined arch, and the cloistered arch, all treated most seriously and in accurate detail; but we fear that few modern students will have the time or the taste to go very deeply into the matters. We greatly question the wisdom of requiring them to. The authors believe that there has been for some time a need for a text book which should furnish not only the exercises and projections now given by a number of works, but practical examples of modern masonry structures, directions for the preparation of drawings, and more of the practical detail of building stone masonry. Perhaps they are right, for undoubtedly the civil engineer of the future will have more to do with masonry arches than he has had in the quite recent past; and, notwithstanding the steel frame, the architect must always be ready to design and to detail good and complicated masonry work. In preparing this little book the authors do not claim originality in the text; but they have aimed to select, to condense and to explain, and they have arranged a text book which is comprehensive enough and detailed enough for any student or practical engineer, and have illustrated their text by pictures of a number of fine recent examples.

A Manual of Drawing. By C. E. Coolidge, Assistant Professor of Machine Design, Sibley College, Cornell University. 8vo., 92 pages, 10 plates. Index. New York: John Wiley & Sons. London: Chapman & Hall, Limited, 1902. $1.00 (paper).

The author of this little manual explains that it was prepared in order to put into permanent form a single and standard draughting room system and so help the student along in his course, which must, in any case, be too short; and which should further give him something of the atmosphere and sensation of the commercial draughting room and teach him one good system well. He describes the materials and instruments, making a thoroughly practical and sensible selection. Then he describes what commercial mechanical drawings are and ought to be, and also gives in much detail the accepted conventionalities. A good index makes it practicable for the student to look up points on which he wants help, and a number of sheets of engravings show examples. These latter, however, are either badly reproduced or badly printed, and perhaps were not originally very well drawn with reference to reproduction, so that they are hardly admirable examples of the results which the student who has carefully followed the author's instructions ought to arrive at. That, however, is no fault of the system.

Ancient and Modern Engineering and the Isthmian Canal. By William H. Burr, C.E., Professor of Civil Engineering in Columbia University; M. Am. Soc. C. E., and of the Institution of Civil Engineers of Great Britain. 8vo. xv + 473 pages. Illustrated, no index. New York: John Wiley & Sons. London: Chapman & Hall, Limited, 1902. $3.50 net; postage 27 cents.

This is a remarkable book, and one of its interesting aspects is as an example of Professor Burr's prodigious industry. Very few men have the resolution to crowd their faculties forward in such unceasing labor and few men could stand such sustained work. In the short hours that he can take from the exacting duties and heavy responsibilities of his position at Columbia University and from the important consulting work which constantly engages much of his time he amuses himself by writing a short encyclopedia of engineering.

This volume is the outcome of a course of six lectures delivered at the Cooper Union, in the City of New York, in February and March, 1902, under the auspices of Columbia University. The president of the university thought that the subject matter of the lectures should be prepared for publication. Therefore, the six lectures have been expanded into the six parts of the book now published. These are Ancient Civil Engineering Works; Bridges; Water Works for Cities and Towns; Some Features of Railroad Engineering; The Nicaragua Route for a Ship Canal; the Panama Route for a Ship Canal. Each of the parts is divided into several chapters, the part on water-works being considerably the longest and that on bridges being next in length. Each of these chapters is divided into a number of special paragraphs and each paragraph is practically a separate topic, is numbered and has a conspicuous side-head. Thus, under water-works, paragraph 142, is First Steam-Pumps, 143 is Water Supply of Paris and London, 144 is Early Water Pipes; or, under the bridge part, paragraph 69 is the Town Lattice Bridge, 70 the Howe Truss, 94 Multiple Systems of Triangulation, 95 Influence of Mill and Shop Capacity on Length of Span. To go back still further, paragraph 5 is on the Change of the Nile Channel at Memphis, paragraph 6 The Pyramids, 8 Nile Irrigation, 21 Early Roman Bridges, 22 Bridge of Alcantara. These examples will give a good idea of the plan of the book. It contains 399 numbered paragraphs.

The statement of this fact and of the origin of the work suggest its limits; that is, 399 distinct topics ranging over the whole field of civil engineering could not be completely treated in 433 pages, octavo. Mr. Burr is the last man in the world to pretend that they could be, but he has made each of his paragraphs thorough and authoritative so far as he professes to go, and we can rely upon the information that we get there. In many cases the information contained in one of these paragraphs will be all that a man wants on that subject, and it will suggest the lines for further inquiry if he wants more. The volume contains many illustrations, all of which actually illustrate, and some of which are of unusual interest. The half-tone illustrations, of which there are many, have been made with scarcely an exception from photographs of the actual subjects illustrated.

If we were to make any criticism of the plan and scope of the book we should say that a good deal of the

bridge theory and mathematics might properly have been left out, but it would have taken uncommon resolution for Professor Burr to do that. Probably that part of the book is the one to which he attaches most value. If we were to permit ourselves further criticism we should say that for a book of this sort a very full alphabetical index is more than desirable, almost essential, and this book has no index. However, the analytical table of contents is so full that it will, in considerable degree, take the place of an index.

The Hardwood Finisher. By Fred. T. Hodgson. Second edition, revised and enlarged. Published by Industrial Publication Co., New York. $1.00.

This book of 100 pages describes simply and clearly the approved methods of finishing, both in natural colors and in stain, the hard woods used in cabinet work. It has a certain value.

TRADE CATALOGUES.

California.—An attractive pamphlet has been issued by the Chicago & North Western R. R. bearing the title "California," which is sufficiently indicative of the contents. It is profusely illustrated with half-tone engravings, many of them full-page, showing California scenery, fruit farms, fruits, etc., with text descriptive of the attractions of this beautiful country.

The Grand Trunk.—The passenger department of the Grand Trunk has sent us a package of attractive advertising literature which was got out for the benefit of the General Passenger and Ticket Agents at the time of the convention at Portland, Me., in October. As is known, the Grand Trunk ran a special train for the members going over its system. Special menus were prepared and the menu cards for breakfast and luncheon, sent with the package, are unique. The former menu is printed on a maple veneer, and the latter on imitation birch bark. A holder for the cards is made from some other of the Canadian woods. There was a handsomely printed programme and an engraved supplementary programme for the trip, which extended from Sunday to Tuesday. The remainder of the literature includes a brochure in flexible cover of undressed pearl-gray calf, silk-lined, printed on heavy enameled paper and filled with half-tone engravings of attractive scenes along the route; an annotated time-table containing descriptive data of the route; a pamphlet on wireless telegraphy; a pamphlet, most artistic in its get-up and illustrations, giving historical facts and description of the Victoria Jubilee Bridge at Montreal; and small maps of Montreal and Portland folded into small leather covers convenient in size for the vest pocket.

The American Brake-Shoe & Foundry Co., New York, have sent out a little pamphlet describing the Tropenas process of making steel castings as used in their plant at Chicago Heights, Ill. It is illustrated with examples of the work turned out by this process which is particularly adapted to making uniform, sound castings of small size.

J. A. Fay & Egan Co., of Cincinnati, has sent out an illustrated catalogue of the patent improved sand-papering machines which it builds. These machines are said to be the first built to carry more than one cylinder. Triple and double-drum sanders are described and a large number of testimonials from users are either reproduced or reprinted. There are also included cuts and descriptions of a number of the newer tools made by the company.

Thread Milling.—The Pratt & Whitney Company, Hartford, Conn., have issued a comprehensive and well arranged pamphlet on the subject of thread milling. It describes in detail a new machine recently put on the market which is designed to turn out screws of great precision. Two sizes are regularly made with a capacity for threading screws 14 in. and 80 in. long respectively. The maximum diameter of screws threaded or spiral gears that can be cut is 6 in. The thread milling cutter is a special patented design, in which the teeth are staggered, each tooth having but one cutting edge. One tooth is left full for the purpose of gauging. A special grinder is built for dressing these cutters. Samples of the work done on this machine are illustrated. Tables are also given in both English and metric units for indexing and setting the cutter.

The Rushmore Lens Mirror Headlight.

The principle of the Rushmore lens mirror locomotive headlight was described in the *Railroad Gazette* Aug. 15, 1902, and we need not now go over that ground again. With a one-foot burner, rated at 70 candle power, the light throws a clear even beam that covers the entire right of way for over 1,500 ft., and the spreading is just sufficient to see the track ahead when on quite sharp curves. The light is not blinding and one may look directly into it at any distance and see the ties right up to the engine. This effect is believed to be due to the even distribution from the large flame and the large lens, which is 13 in. in diameter, and is ground and polished true.

One of these lights was placed last May on the big Chautauqua type engine No. 591 on the Central of New Jersey, which has since made 360 miles every day at speeds often exceeding 80 miles an hour. On this type of engine the oil lights would occasionally burn up and frequently blow out when passing close under bridges at such speeds. The new light has worked so well that the company soon after ordered a dozen other engines equipped and have since adopted it as a standard, replacing the oil lights. Forty new engines to be delivered in May, 1903, will also use them.

One of the new Prairie type Baldwin suburban engines is shown in Fig. 1 fitted with two headlights supplied from a single acetylene generator mounted on the front-end, and Fig. 2 gives a view of the front-end, showing the method of mounting the generator.

The headlight is made of castings and a simple galvanized iron drum. The side lights are standard size and are fitted to cast-iron hinged doors. The only attention the light requires is to wipe off the lens and front glass, which is ¼ in. polished plate. It is claimed that the light may be easily lighted with a match when running 60 miles an hour.

The generator consists of a lower rectangular receptacle with a gas tight door, which carries a large ash pan, and an upper water tank. Upon the top of the pan

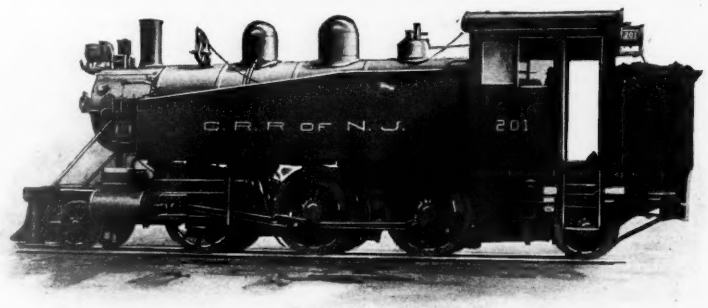


Fig. 1.—Suburban Locomotive with Two Rushmore Headlights—Central Railroad of New Jersey.

is a removable grate upon which is placed about 8 lbs. of large lump calcium carbide. Over the grate there is a water spray pipe. As the carbide is consumed the lime dust falls into the ash pan, from which it is removed as a dry powder, and the unused carbide remains on the grate in clean free lumps, and thus the charging consists merely in dumping out this dust and adding a lump or two to the grate, the entire operation taking less time than to fill an oil lamp.

The generator is made of brass castings and sheet copper riveted and soldered. Thus a leak at any time may be permanently soldered and the metal is always of value as scrap.

The generator contains no working parts and no adjustments are required. The water is always left wide open and the gas always on tap except when recharging, and thus the gas may be used for the cab lights. To prevent freezing of the water a loop of ¾ in. pipe is dropped from two connections in the side of the water tank for about 12 in. into the smoke-box and the heat from the flue gases sets up a circulation and keeps the water in the tank comfortably warm when running at high speeds in zero weather. This simple arrangement does away with steam heating coils and drips to watch.

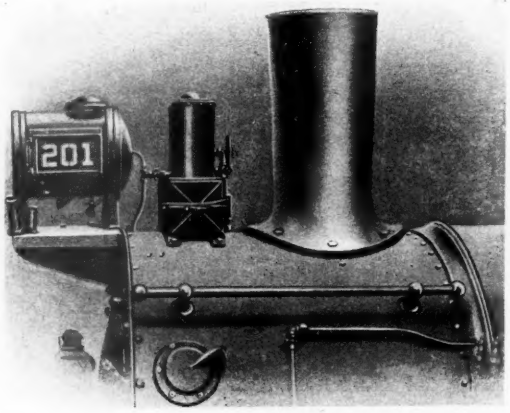


Fig. 2.—Method of Mounting Rushmore Lens Mirror Headlight.

The railroads using the new light report that it costs less than one cent an hour to operate, and that it is cheaper than the oil light, considering that it is practically indestructible, requires no chimneys, lamp wicks or new front glass. The lens has only to be wiped off to be equal to new, and there is thus an entire saving for polishing and silver plating the reflectors.

The lights are reported to have given perfect satisfaction on the Central of New Jersey and the Reading. The generator supplies the light for 48 hours and the cost for carbide is about ¾ cent an hour.

Press despatches state that in the suit of the Taff Vale Railway against the Amalgamated Society of Railway Servants, for damages sustained by the company by reason of the boycotting and picketing of the strikers belonging to the Society has been decided in favor of the railroad, and that the jury has awarded the company substantial damages. It will be remembered that a former decision had settled it that the Treasury of the Society was liable for damages done by members.

Interstate Commerce Commission's Sixteenth Annual Report.

[*From a synopsis issued by the Secretary.*]

The preliminary income account for the year ending June 30, 1902 (*Railroad Gazette*, Dec. 5, p. 922), compiles returns from companies operating 98 per cent. of the entire mileage of the United States, and shows that as compared with the previous year the net earnings are greater by some $51,000,000, and the amount paid in dividends on stock greater by nearly $30,000,000. It is interesting to contrast this showing with the statistics for 1897. As the rates, broadly speaking, were about the same in both years, it follows that the large increase in earnings resulted mainly from the increased volume of traffic, indicating the great prosperity enjoyed by the railroads.

The tendency to combine continues to be the most significant feature of railroad development. The competition between railroad carriers which formerly prevailed has been largely suppressed, or at least brought to the condition of effective restraint. The progress of consolidation, in one form or another, will at no distant day confine this competition within narrow and unimportant limits, because the control of most railroad properties will be merged in a few individuals whose common interests impel them to act in concert. While this will insure, as probably nothing else can in equal degree, the observance of published tariffs, and so measurably remove some of the evils which the act was designed to prevent, the resulting situation involves consequences to the public which claim the most serious attention. A law which might have answered the purpose when competition was relied upon to secure reasonable rates is demonstrably inadequate when that competition is displaced by the most far-reaching and powerful combinations. So great a change in conditions calls for corresponding change in the regulating statute.

It is now nearly 16 years since the passage of the act to regulate commerce, and more than 13 years since it has been amended in any material respect. At the time of its adoption it was understood to be more or less tentative and experimental. In the principles declared there is no unsoundness or want of adequate statement. The defect is not in the rules formulated but in the machinery provided for the enforcement of those rules. The law has furnished a considerable restraint upon the carriers and promoted in a substantial degree the ends which it was designed to secure. Nevertheless, its inadequacy was long ago discovered. That this imperfection is curable is equally conceded. The fullest power of correction is vested in the Congress and the exercise of that power is demanded by the highest considerations of public welfare.

. . . This subject cannot be more forcibly presented or the situation more clearly explained than has been done in former reports. A sense of the wrongs and injustice which cannot be prevented in the present state of the law, as well as the duty enjoined by the act itself, impels the Commission to reaffirm its recommendations, for the reasons so often and so fully set forth. The Commission regards this matter as increasingly grave, and desires to emphasize its conviction that the safeguards required for the protection of the public will not be provided until the regulating statute is thoroughly revised.

The Injunction Suits.—Investigations undertaken by the Commission in December, 1901, and January, 1902, showed that rates upon grain and grain products and packing-house products were in a most demoralized condition. The evidence taken was referred to the Attorney-General, but no convictions have yet been obtained, nor, so far as the Commission knows, have any indictments been found. Believing that no relief could be hoped for from criminal proceedings, the Commission considered whether the desired end might not be obtained by another method, and the course finally adopted was to apply to the Federal Courts at Kansas City and Chicago asking that the railroads implicated be compelled by mandatory process to observe their published schedules. A restraining order or preliminary injunction was granted against the Santa Fe, Rock Island, St. Paul, Burlington, Missouri Pacific, Alton, Chicago Great Western, Michigan Central, Lake Shore, Pennsylvania, Northwestern, and Illinois Central systems in March, 1902, and has since continued in effect. The case was set for argument before the circuit court on the 15th of this month.

The roads against which these restraining orders were granted are among the most important in the sections in which they operate. The injunction applies not only to grain and packing-house products, but to all commodities. It is claimed, and the Commission believes, that these railroads have obeyed, in the main, the injunctions; that published rates have been exacted upon these lines and very generally by other lines in competition with them, and it can hardly be doubted that a very much better condition has existed in the last nine months in

this respect than for any corresponding period in the last 12 years at least.

Whether a continuance of the injunctions would work a continuance of this improved condition is not certain, but the Commission is inclined to think it would to a considerable extent, not only because departure from the published rate can be more easily and summarily dealt with in injunction proceedings than by criminal indictment, but also because of changes in the ownership of railroad properties and the lesson which past experience has taught railroad operators. The right to proceed in this manner to restrain violations of the act is of great value, but attention is called to the fact that the right to so proceed is at least doubtful. While railroad managers have, as a rule, welcomed these injunctions as applied to the maintenance of rates, the principle involved is stoutly contested in a case now pending before the United States Supreme Court. Congress has the undoubted power to invest Federal courts with this authority, and it would relieve the present uncertainty if an enactment to that effect could be had at the present session.

The report then goes on to state the changes in rates on grain products and packing-house products since Jan. 1, 1901, showing considerable advances, especially since the issuance of the injunctions.

The Commission concludes, first, that the effect of these injunctions has been to materially advance on these commodities the rate actually received by the carrier and actually paid by the shipper, and, second, that their operation as applied to the present condition of railroad ownership enables advances in rates which might not otherwise be made and maintained. While the producer of grain will undoubtedly pay from now on from 5 to 7 cents, in some instances 10 cents, per 100 lbs. more to transport that grain from the field to destination than he had paid for some time before these injunctions took effect, this is not to be regarded as an argument against the injunctions. Everyone concedes that carriers should publish their rates and maintain the rates when published. It does show, however, that there ought to be some power, in court or commission, or elsewhere, which cannot only compel these carriers to maintain the published rate but which can compel them to publish a fair and reasonable rate.

Publication and Filing of Tariffs.—While the majority of tariffs are readily comprehended by almost anyone, there are many in which the application of the rates is so imperfectly shown, that it is often very difficult for even a tariff expert to correctly determine the rates therefrom. Another source of complication is the issuance of a large number of supplements to the original tariff, sometimes to the extent of a hundred or more, thus rendering the task of ascertaining the correct rates a tedious process. Such tariffs are doubtless in large measure responsible for the great number of overcharges which occur. It is also true that a large number of undercharges occur from the same source. . . . The law requires that schedules shall be printed in such form as to be plain and comprehensive to the ordinary shipper. Several other unusual and confusing methods of publishing rates are also stated.

Formal Proceedings.—Thirty-eight formal proceedings, double the number brought in the preceding year, have been instituted before the Commission since its last report to Congress. These cases directly involve some of the rates and practices of 300 carriers. The report contains a brief statement of the points involved in these cases.

Decisions.—Many important questions arising in contested cases have been decided during the year. The questions so decided by the Commission are summarized in the report. They involve the following subjects: Denying shippers their choice of established routes; milling in transit; differences in transcontinental carload and less than carload rates; blanket rates; rates to Pacific coast terminals and intermediate territory; contract rates lower than those specified in the published tariff; classification of hay and straw; long and short haul charges; publication of tariffs, and discrimination in furnishing cars.

Cases Pending in the Courts.—Besides the injunction proceedings mentioned above, 10 civil cases to enforce orders of the Commission are pending in the Federal courts. The criminal proceedings instituted during the year are also stated. The indictments are described as follows: Failure to file tariffs with the Commission as required by section 6 of the act; pooling of cotton shipped from Memphis, Tenn.; pooling of cotton shipped from Atlanta, Ga.; and departure from published tariff rates.

Court Decisions.—Three court decisions have been rendered during the year in cases involving enforcement of orders of the Commission. One of these cases, known as the Chicago Live Stock Terminal Rate case, was decided by the United States Supreme Court in favor of the carriers, but with leave to the Commission to take further testimony upon the extent and effect of a certain reduction in live stock rates, which was the basis of the adverse decision by the court. The other two cases were the Danville, Va., Long and Short Haul case, decided in favor of the carrier, and the Savannah, Ga., Naval Stores and Cotton case, in which the order of the Commission was sustained.

Other court decisions are discussed in the report under the headings of "Discriminations in Coal Rates," "Delivery of Live Stock to Competing Stock Yards," "Contract Rate Lower Than Rate Specified in the Published Tariff," "Limitations Upon Actions Brought Under the Interstate Commerce Act," "Accident to Passenger Riding on a Pass," "Through Routes and Through Rates," "Is Transportation Passing Through Different States, but Beginning and Ending in the Same State, Subject to Regulation by State or National Authority?" "Discrimination in Furnishing Cars."

The Safety-Appliance Law.—The gratifying results of the safety-appliance law of 1893 have been increasingly evident during the present year. The number of persons killed and injured in coupling and uncoupling cars during the year ending June 30, 1902—the first entire year reported since the law went into full effect—shows a diminution as compared with 1893, the year when the law was passed, of 68 per cent. in the number killed and 81 per cent. in the number injured.

But casualties continue to occur, and their number is such as to call for continued and earnest efforts to eliminate their causes. Although we have the automatic coupler, there are dangers against which it does not fully provide, such as cars moved while not in complete running order; poorly constructed couplers; cars failing to couple except by violent impact, leading to breakage, delays, and annoyances; men going between the cars to prepare for a second coupling trial; defective uncoupling levers or rods and their connections. A perfect uncoupling device is as clearly required by the statute as is the automatic coupler.

The report mentions data contained in a report by its chief inspector concerning defective couplers on freight cars of the country. Ten inspectors employed by the Commission up to June 30, 1902, examined 161,371 cars, as against 98,624 examined by a smaller force during the year previous. Defects were found in 42,718 as compared with 19,462 the previous year, the percentage found defective being 26.47, as against 19.73 in the year preceding. An improvement noted is the increased use of solid knuckles and diminution in the number of uncoupling rods incorrectly applied.

While the use of power-brakes on freight trains has improved during the year, as in the case of the automatic coupler, there is still need of further progress in this respect. The percentage of air-braked cars used in trains is greater than a year ago, but in a great many trains it is still too small, and the use of hand-brakes as the main or only means of regulating the speed on steep descending grades continues on some of the important roads.

The great increase in the volume of freight traffic on nearly all railroads, which was noted a year ago, has continued unabated, and the burdens which this pressure of work has put upon officers and employees in the freight-train departments have hindered them from giving due attention to brakes. There is pressing need of better records for the purpose of making a more thorough study of causes of coupler failures.

The Commission recommends passage of an act forbidding the running of trains in which less than one-half of the cars are equipped with power brakes, in operative condition, and suitably connected to the engine, and empowering the Commission to issue a general order or orders requiring the use of power brakes on more than 50 per cent. of the cars in a train as and whenever it shall find such increased use to be practicable; and also permitting the Commission, in the case of any particular road, after hearing and investigation, to permit, for a specified period, the running of trains with power brakes in use on less than 50 per cent. of the cars therein. This recommendation is in accordance with facts and interviews brought out at hearings before the Senate and House committees of the last session of Congress. The Commission further recommends that the provisions relating to automatic couplers, grab irons, and height of drawbars be applied to all locomotive tenders, cars, and similar vehicles, both those used in interstate commerce and those in connection therewith, except those trains, cars, and locomotives exempt under the present law; and that the size, length, and location of grab irons shall be prescribed by the Commission.

Accident Reports.—The act of March 3, 1901, requiring railroads to report accidents monthly to the Commission has been in operation since July 1. Four quarterly bulletins have been issued giving summary tables of statistical information derived from the railroad companies' reports and particular information concerning the causes of some of the more serious accidents. Mention is made in this connection of the danger attending the movement of the later designs of large-capacity cars in respect to their increased width. This reduces the clearance between tracks to such an extent that it is often difficult for a man to pass between cars on different tracks.

In the matter of collisions and derailments, the statistics gathered under the law of 1901 constitute the first authentic record of the kind which has ever been published relating to railroads of the whole country. The figures compiled by the Commission for the year ending June 30, 1902, show approximately 2.5 collisions and 1.8 derailments per 100 miles of railroad for the year; and the losses by accidents, not including damage to freight or sums paid to persons for bodily injuries or on account of death, average, roughly, $3,800 per 100 miles of road annually. The enforcement of regulations, the neglect or violation of which has caused these collisions, has long been the subject of extended discussion among railroad officers, but such discussions have not resulted in marked improvement, except as they had led to the adoption of the block system. This system is treated at length in the report and highly commended.

Per Diem Rates for Car Service.—The report notices and commends the change made by carriers, through the action of the American Railway Association, substituting per diem instead of mileage rates as the basis of settlements for the interchange of freight cars between the different railroads. In the agreement to abolish mileage payments, the railroads were unable to include cars owned by private companies, such as dressed-beef and fruit shippers, the coal and other mining companies, the cattle-car and oil companies, and the one fast-freight line which runs cars not owned by the railroads. This failure to agree perpetuates a long-standing abuse, which has been referred to in previous annual reports of the Commission. It is understood that the proposition to abolish mileage on private cars was blocked by time contracts under which certain carriers had agreed to pay mileage rates for shippers' cars. The estimated value of these private cars is $84,554,750. During the year ending June 30, 1901, the carriers reporting to the Commission their payments for the use of private cars paid out for this purpose a sum in excess of $12,000,000. The owners of these cars are not common carriers, and are not subject to the act to regulate commerce, and no authority supervises their accounts. This is a matter of grave importance, which may well engage the attention of Congress.

Regulating the Practice of Engineering.*

. . . So far as the Committee is advised, there exist no laws in the United States regulating or limiting the practice of engineering in any of its branches, with the exception of the Architects' law mentioned later. Efforts have been made in a few States to secure the enactment of such laws, but without success.

In Canada the subject has been agitated for a number of years, with the result that acts relating to Civil Engineers have been passed in the Provincea of Quebec and Manitoba. These acts are quite similar in their essential requirements.

The Quebec law, which was approved Jan. 15, 1898, after reciting in the preamble the fact of the incorporation of the Canadian Society of Civil Engineers, and declaring that it is desirable to establish the qualifications necessary to authorize persons to practice as Civil Engineers in the Province, enacts that, after Jan. 1, 1899, no person shall be entitled to use the title of Civil Engineer or to practice the profession unless he shall be, or shall become, a member of the Canadian Society of Civil Engineers. It defines the qualifications necessary for admission to the Society, and the conditions of membership. A board of examiners is constituted, consisting of six persons, four of whom shall be named by the council of the Society, and one each by McGill University and Laval University. This Board shall meet at least twice each year to examine candidates who may apply for admission to the Society either as students or as corporate members. Those admitted as students may be, after passing a later prescribed examination, admitted as corporate members. In either case the applicant must pay in advance of the examination the entrance fees to the Society. Persons who pass the advanced examination receive a diploma, and become without further action on the part of the Society, corporate members.

The act prescribes that no by-law that may be adopted by the Society shall have force or effect until approved by the Lieutenant Governor of the Province. The practical effect of the law is to make corporate membership in the Canadian Society of Civil Engineers the condition upon which the profession may be practiced in the Province. Exception is made in the case of persons authorized to practice by previous legislation. Persons not thus authorized to practice cannot recover before any court or justice any sum of money for civil engineering services, and they are liable to a fine not exceeding $25 for assuming or using the title of Civil Engineer or of membership in the Society.

The Manitoba Act, . . . while its leading provisions are quite similar to those of the Quebec Act, it is somewhat more liberal, since it exempts persons practicing Civil Engineering at the time the act was passed, as well as members of National Societies of Civil Engineers, and those upon whom the degree of Civil Engineer may be conferred by institutions of learning. The Act provides no penalty for its violation. Efforts have been made to secure the passage of a similar law by the Provincial Parliament of the Province of Ontario, but so far without success, an act very similar to the Quebec Act having been rejected at the last session of the Parliament.

These Canadian measures have not been in force long enough to afford a practical test of their value, particularly as no serious attempt has yet been made to enforce them rigorously. . . .

Mexico has a system of licensing engineers that possesses, in theory at least, some meritorious features. . . . The Committee has not been able to ascertain that any provision exists in European countries for the licensing of engineers or for the regulation of professional practice except in so far as such regulation may be brought about by the civil service examinations in force in most of these countries. . . . Correspondence with engineers in England, Germany and France indicates that in their opinion no legal regulation of practice has been found necessary or is thought desirable.

With the exception of the Ministry, practice in all the professions other than engineering is regulated by law in nearly all the States of the United States. . . . In the law, regulations governing admission to the Bar are in force in all the States and Territories. . . . In the medical profession there has been a marked increase in the requirements, though there is great diversity in those of the different States. . . . In dentistry, license to practice is required in nearly all the States, such licenses being generally issued to those having diplomas from dental colleges, though 23 States require a special examination, even where the applicant is in

*Extracts from a report presented by a special committee at the Washington Meeting of the American Society of Civil Engineers.

possession of a diploma. . . . In architecture, efforts have been made in a number of States to secure legislation defining the duties and regulating the practice of architecture, but, up to the present time, only three States—California, New Jersey and Illinois—have laws licensing architects. The Committee is informed that there is much difference of opinion among architects as to the desirability of such laws, and in a number of States where the matter has been agitated the profession has been found almost equally divided for and against them. . . . The arguments in favor of some effective measure to prevent the practice of quackery in the profession and to protect the public from imposition are so familiar to all that it is unnecessary to repeat and review them in this report. There can be no doubt that a large number among the reputable engineers now in practice are earnestly in favor of regulation and restriction, not only in the interest of the profession, but for the protection and benefit of the public. On the other hand, the discussion of the subject at the last Convention, and since, discloses clearly the fact that a large number of engineers, among them some of the leading members of the profession, believe that such restrictive measures are not only unnecessary, but inexpedient and unwise.

The members of the Committee are not unanimous in the opinion that it is desirable to restrict engineering practice in order to exclude incompetents, even if it were possible to secure satisfactory legislation to accomplish that purpose.

After a careful study of the matter in all its bearings the Committee has arrived at the conclusion that *it is inexpedient for the Society to take any action in the matter* at this time, only one of its members inclining to the opposite view.

Some of the reasons that have led to this conclusion are the following:

Legislation intended to regulate and control professional practice should be of substantially uniform character and application throughout the whole of the United States. As it is not within the province of the National Government to enact such legislation, it could only be secured through the independent action of the several States. . . . It is quite improbable that the legislation necessary to regulate engineering practice could be secured in the several States without the approval and active co-operation of a large majority of the people. . . . The two main arguments that have been advanced in favor of a measure of this character are that it would be beneficial to the profession, and that it is necessary for the protection of the public.

The fact that legislation is designed for the protection of any one class, however large and important that class may be, would very certainly arouse opposition to it, on general principles. . . . The basis on which restrictive legislation has been secured in the practice of medicine, pharmacy and dentistry is the police power of the State to protect life and health; the attorney is, in theory at least, an officer of the Court, and is, therefore, a part of the machinery for the administration of justice; and the character and ability of the public school teacher is a matter in which every citizen is interested and into which he has a right to inquire. No such broad and general basis can be claimed for the engineering profession. . . .

To secure the enactment of any laws of the character contemplated it would undoubtedly be essential that the profession shall be united in its demand for them. It is evident that at present such unanimity does not exist.

Granting that restrictive legislation could be secured, and enforced, a careful study of the details necessary to be considered in framing the terms of the measure discloses the fact that very serious difficulties would be met with in attempting to provide, on the one hand, such definite conditions as would make the enactment effective, but which would not, on the other hand, impose restrictions on the individual liberty of the citizen. . . . It would be very desirable that any legislative regulation should be of such a general character as to embrace the whole field of engineering. Such general legislation could not be framed without a very careful study of existing conditions, and of controlling facts and principles from the standpoint of each department of the general profession, and its passage could not be secured without the active co-operation of the professional organizations of the several divisions of the profession. With the exception of the architects, the other branches of the profession, so far, have shown no active disposition to take up the matter of legislative control of professional practice, and the Committee is of the opinion that efforts to obtain their co-operation at the present time would be fruitless. . . .

The Committee recommends that no further action be taken in the matter by the Society at the present time.

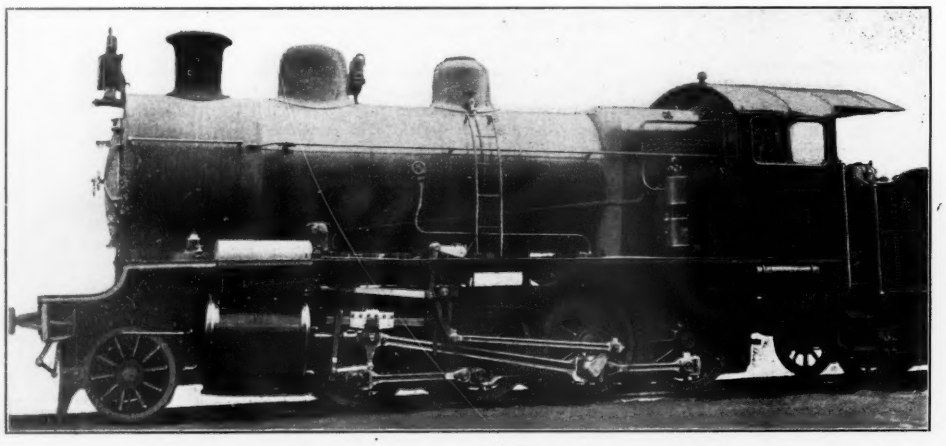
This report is signed by Messrs. S. Whinery, Desmond FitzGerald, J. F. Wallace, A. N. Talbot and Emil Kuichling.

Mineral Traffic Engines for the Norwegian State Railroads.

BY C. R. KING.

There is at present a very marked tendency in Europe towards the adoption of much more powerful freight locomotives than have hitherto been employed. The most notable advances have been, or are being made, on the Paris, Lyons & Mediterranean and on the "Est" of France, on the Strade Ferrate Mediterranee of Italy, and on the State Railroads of Norway.

The Norwegian consolidation engine illustrated herewith is a cross compound. The fire-box is copper, almost square, and tapers slightly towards the top. The wide water spaces around it are braced to the boiler-head by short palm-stays in vertical rows. The overhanging fire-box is fastened to the frames by special expansion slide brackets lined with bronze and provided with small lubricators beneath. The cylinders are 21⅝ in. and 32¼ in. in diameter respectively, with a stroke of 25¼ in. The intercepting-valve is a modification of one suggested long ago by A. Mallet, and improved upon by the Schweizerische Lokomotiv & Maschinen Fabrik, and for some time in very successful operation on certain Swiss lines, including the Nord-Ost Bahn.



Compound Locomotive of the Norwegian State Railways.

When starting and down to a cut-off of 70 per cent., the engine works as a simple two-cylinder engine; but when linked up to less than that amount, the intercepting-valve closes the high pressure exhaust to the stack and the machine then works as a compound. The slide-valves are of the Von Borries balanced pattern, and the blast-pipe and fixed nozzle are also calculated according to the formula of Von Borries.

In accordance with American practice the smoke-box is provided with netting and a cinder-pot. The smoke-box resembles those of English construction, i. e., the smoke-box plates are secured to an angle-iron hoop riveted to the back face of the tube sheet. The tube plate is of the usual flanged circular form, and the plates of the diaphragm are fastened to the end boiler ring by means of a thick welded hoop, thus making the smoke-box about 5 ft. 11 in. in diameter.

The Winterthur Works, the builders of this engine, obtain all their most important castings from the foundry of the celebrated steam engine makers whose works adjoin—Messrs. Sulzer Bros.

The total weight of the engine is 79 tons, with 68 tons on the drivers. The maximum tractive effort is 25,300 lbs.

Allowance for turning curves is made by a direct lateral play of ⅝ in. in the boxes of the second and fourth driving axles, while the pony truck axle has a radial play of 2 in. The tender is carried on two four-wheel trucks of the Norwegian diamond-frame pattern with channel iron bolsters.

The special equipment consists of two 3½ in. Coale safety valves; three Friedmann injectors; two Nathan sight-feed lubricators; Friedman oil force pump; Haushälter speed indicator and recorder; pneumatic sand sprayer; United States metallic packing for glands, etc. The Westinghouse brake acts upon the driving and tender wheels. A reserve steam-brake is provided for the driving wheels and a hand-brake for the tender.

These locomotives will, in the course of the coming year, be put to mineral train service upon the Ofoten division in North Norway, where the maximum grades are 1 in 60 and the rails weigh 80 lbs. to the yard.

Dimensions follow:

Description.	
Fuel	English coal
Weight on drivers	136,000 lbs.
Weight on truck wheels	22,000 lbs.
Weight, total	158,000 lbs.
Weight tender loaded	38,000 lbs.

General Dimensions.	
Length over all, engine	36 ft. 4¾ in.
Length over all, total, engine and tender	54 ft. 8 in.
Height, center of boiler above rails	8 ft. 8¼ in.
Height of stack above rails	14 ft. 1¼ in.
Heating surface, fire-box	125.8 sq. ft.
Heating surface, tubes	1,786.2 sq. ft.
Heating surface, total	1,912 sq. ft.
Grate area	29.8 sq. ft.
Wheels and Journals.	
Drivers, number	8
Drivers, diameter	49⅛ in.
Cylinders.	
Cylinders, diameter	21⅝ in. and 32¼ in.
Piston, stroke	25¼ in.
Boiler.	
Working steam pressure	174½ lbs.
Diameter of barrel	66⅛ in.
Fire-box.	
Length	6 ft. 7½ in.
Width	4 ft. 5 in.
Tubes.	
Number	273
Outside diameter	2 in
Other Parts.	
Exhaust nozzle, variable or permanent	Permanent
Netting, wire or plate	Wire
Stack, least diameter	20½ in.
Tender.	
Tank capacity for water	3,300 gal.
Coal capacity	4½ tons

The Education of the Engineer.

[At the recent meeting of the British Association, Professor John Perry, F. R. S., the President of the Section of Engineering, spoke on the education of the engineer. A few extracts from his pithy and wise address are given below.]

When a man has become a great engineer, and he is asked how it happened, what his education has been, how young engineers ought to be trained, as a rule it is a question that he is least able to answer, and yet it is a question that he is most ready to answer. It often happens that he is a man who is accustomed to think that early education can only be given through ancient classics. He forgets the dullness, the weariness of his school-days. The cleverest men of our time have been brought up on the classics, and so the engineer who cannot even quote correctly a tag from the Latin grammar, who never knew anything of classical literature, insists upon it that a classical education is essential for all men.

He forgets the weary hours he spent getting off Euclid, and the relief it was to escape from the class-room not quite stupefied, and he advocates the study of pure mathematics and abstract dynamics as absolutely necessary for the training of the mind of every young engineer. I have known the ordinary abominable system of mathematical study to be advocated by engineers who, because they had passed through it themselves, had really got to loathe all kinds of mathematics higher than that of the grocer or housekeeper. They said that mathematics had trained their minds, but they did not need it in their profession. There is no profession which so much requires a man to have the mathematical tool always ready for use on all sorts of problems. The average boy leaves an English school with no power to think for himself, with a hatred for books, with less than none of the knowledge which might help him to understand what he sees, and he has learnt what is called mathematics in such a fashion that he hates the sight of an algebraic expression all his life after.

I think we may assume that there never yet was an engineer worth his salt who was not fond of engineering, and so I shall speak only of the education of the young man who is likely to be fond of engineering.

I had already been an apprentice for four years at the Lagan Foundry when I entered Queen's College for a course of civil engineering. I suppose that there never was on this earth a college so poorly equipped for a course of engineering study. But there was as professor a man of very great individuality; he acted as president of this section 28 years ago. I can hardly express my obligations to Professor James Thomson. It was my good fortune to be a pupil both of this great man and of his younger brother, Lord Kelvin, as well as of Dr. Andrews. All the scientific men of the world are agreed to call these men very great indeed. To come in contact with any of them, even for a little while, as a student, altered forever one's attitude to Nature. It was not that they gave us information, knowledge, facts. The syllabuses of their courses of study were nothing like so perfect as that of the smallest German polytechnic. Yet if a youth with a liking for physical science had gone to a German gymnasium to the age of 19, and had become a walking encyclopædia on leaving his polytechnic at the age of 24, the course of that life-study would not have done for him as much good as was done by a month's contact with one of these men.

James Thomson taught me to see that the very commonest phenomenon had still to reveal important secrets to the understanding eye and brain, and that no man is a true student unless he is a discoverer. And so it was with Kelvin and Andrews. Their names were great before the world, and yet they treated one as a fellow student. Is any expenditure of money too large if we can obtain great men like these for our engineering colleges?

Well-equipped schools of applied science are getting to be numerous, but only a few of the men who leave them every year are really likely to become good engineers. The most important reason for this is that the students who enter them come usually from the public schools; they cannot write English; they know nothing of English subjects; they do not care to read anything except the

sporting news in the daily papers; they cannot compute; they know nothing of natural science; in fact, they are quite deficient in that kind of general education which every man ought to have. I am not sure that such ignorant boys would not benefit more by entering works at once than by entering a great engineering school.

Our school system resembles the ordinary type of old-established works, where gradual accretion has produced a higgledy-piggledy set of shops which one looks at with stupefaction, for it is impossible to get business done in them well and promptly, and yet it seems impossible to start a reform anywhere. What is wanted is an earthquake or a fire—a good fire—to destroy the whole works and enable the business to be reconstructed on a consistent and simple plan. And for much the same reason our whole public school system ought to be "scrapped." What we want to see is that a boy of 15 shall have had mental training in the study of his own language, in the experimental study of mathematics, and in the methods of the student of natural science. Such a boy is fit to begin any ordinary profession, and whether he is to enter the Church, or take up medicine or surgery, or become a soldier, every boy ought to have this kind of training.

Thanks mainly to the efforts of a British Association Committee, really good teaching of experimental science is now being introduced into all public schools, in spite of most persistent opposition wearing an appearance of friendliness. In consequence, too, of the appointment of a British Association Committee last year, at what might be called the psychological moment, a great reform has already begun in the teaching of mathematics. The teaching of mechanics and mechanical engineering through experiment is comparatively unknown. Cambridge writers and other writers of books on experimental mechanics are unfortunately ignorant of engineering. University courses on engineering—with one splendid exception, under Professor Ewing at Cambridge—assume that undergraduates are taught their mechanics as a logical development of one or two axioms; whereas in many technical schools under the Science and Art Department apprentices go through a wonderfully good laboratory course in mechanical engineering. We really want to give only a few fundamental ideas about momentum and the transformations of energy and the properties of materials, and to give them from so many points of view that they become part of a student's mental machinery, so that he uses them continually.

The difficulty about all laboratory exercise work worth the name is that of finding demonstrators and assistants who are wise and energetic. Through foolishness and laziness the most beautiful system becomes an unmeaning routine, and the more smoothly it works the less educational it is. In England just now the curse of all education is the small amount of money available for the wages of teachers—just enough to attract mediocre men. I have been told, and I can easily imagine, that such men have one talent over-developed, the talent for making their job softer and softer, until at length they just sit at a table, maintaining discipline merely by their presence, answering the questions of such students as are earnest enough to come and worry them. There ought to be very much higher wages all round in the teaching profession. Most of the students at Finsbury were preparing for electrical or mechanical engineering, and therefore we thought it important that nearly every professor or demonstrator or teacher should be an engineer. I know of nothing worse than that an engineering student should be taught mathematics, or physics, or chemistry by men who are ignorant of engineering, and yet nothing is more common in colleges of applied science. The usual courses are only suitable for men who are preparing to be mere mathematicians, or mere physicists, or mere chemists.

Mathematics and physics and chemistry are usually taught in watertight compartments, as if they had no connection with one another. The usual mathematical teacher thinks most of those very parts of mathematics which to an ordinary man who wants to use mathematics are quite valueless, and those parts which would be altogether useful and easy enough to understand he never reaches; and so it is also in chemistry. Luckily, the physics professor has usually some small knowledge of engineering; at all events he respects it. When the pure mathematician is compelled to leave the logical sequence which he loves to teach mechanics he is apt scornfully to do what gives him least trouble—namely, to give as "mechanics" that disguised pure mathematics which forms 90 per cent. of the pretence of theory to be found in so many French and German books on machinery. But how is a poor mathematical professor who dislikes engineering, feeling like Pegasus harnessed to a common wagon—how is he to distinguish good from evil? He fails to see how worthless are some of the books on "theoretical mechanics," written by mathematical coaches to enable students to pass examinations. An engineer teaching mathematics would avoid all futilities; he would base his reasoning on that experimental knowledge already possessed by a student; he would know that the finished engineer cannot hope to remember anything except a few general principles, but that he ought to be able to apply these, clumsily or not, to the solution of any problem whatsoever. Of course he would encourage some of his pupils to take up Thomson and Tait, or Rayleigh's "Sound," or some other classical treatise as an advanced study. Not only do I think that every teacher in an engineering college ought to have some acquaintance with engineering, but it seems to me equally important to allow a professor of engineering, who ought, above all things, to be a practical engineer, to keep in touch with his profession. A man who is not competing with other engineers in practical work very quickly becomes antiquated in his knowledge.

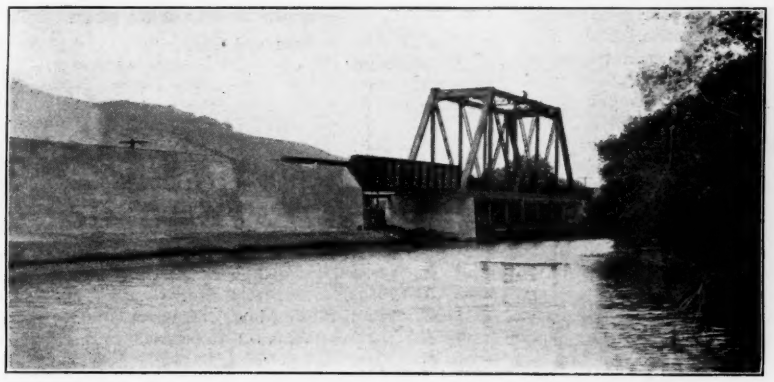
First Thirty Miles of the San Pedro Road.

About Oct. 15 the San Pedro, Los Angeles & Salt Lake Railroad completed its first 30 miles out of Los Angeles to Pomona. The roadbed is 18 ft. wide, with gravel ballast, laid with 75 lb. rail, Am. Soc. C. E. section, with 18 redwood ties to the 30-ft. rail, and tie plates on every tie. All new orders for rails will be 33 ft. lengths. The maximum grade on the line, so far built, is 50 ft. to the mile, while the maximum curve is 3 deg. with easement curves.

There is a large amount of heavy concrete and steel bridge work on this 30 miles. At the Puente dam is a bridge on concrete piers, having at the east end a wall of concrete for protection against the winter floods. The concrete foundations rest on piles.

There are two other notable structures on this line—the San Gabriel bridge and the Rio Hondo bridge. The San Gabriel (the longest bridge on the line) has three 110 ft. spans, with a 60-ft. plate girder on the east end. On the west end is 650 ft. of trestle work to be filled hereafter. The Rio Hondo bridge has four 60 ft. span plate girders on concrete piers, and at either end is a concrete abutment with a 30-ft. concrete arch. The method of running in the girders for the Rio Hondo structure was illustrated in our issue of May 16. There are eight such structures in this 30 miles of line, all within 16 miles of Los Angeles.

The heaviest locomotives running on the line are 20 x 28 ft., 10-wheelers with 144,000 lbs. on drivers, and total weight of engine and tender, loaded, 309,050 lbs. Oil is used for fuel. It is claimed that when the new line is in operation 20 minutes will be cut from the running time from Pomona to Los Angeles.



Bridge at Puente Dam.

Rio Hondo Bridge—San Pedro, Los Angeles & Salt Lake Railroad.

An English View of American Rolling Stock.

We continue the publication of a few notes from the report of Colonel Constable, R. E., on the working of American railroads. He approves decidedly of our long passenger cars on bogie trucks. Before he left India he sanctioned the programme for building the new passenger stock for the Eastern Bengal State Railway on these lines, and he thinks that the practice is becoming universal in India, as well as all over the world. He liked the commodious width of the American passenger cars and thinks that the Indian stock might be modified in this way. American roads with a gage of 4 ft. 8½ in. use cars 10 ft. wide, and some Continental systems go to 10 ft. 6 in. It seems a pity that in India with 5 ft. 6 in. gage, cars should be everywhere restricted to 9 ft. 6 in. in useful width.

He is convinced from his observations in America that the longer and heavier the passenger car the better it rides and the easier it goes around curves at fast speed. He considers that the American car 75 ft. to 80 ft. long is safer and runs better at high speed than the English car 69½ ft. long over buffers. The Indian railroads were in error in building their coaches 50 ft. to 60 ft. long for fast mail service.

He does not altogether approve of our sleeping cars, and is disposed to think it would be much better that the railroad companies should themselves operate these cars. The charges are high, the cars are hot and stuffy, there is no room for hand baggage under the seat, the windows are hard to open, and there are no separate berths reserved for ladies. The cars are overloaded with ornament.

He would be glad to see a hundred or so of our 50-ton steel cars tried in India. For instance, he computes a train loaded to full capacity as carrying 3,333 lbs. of live load to the running foot, while in India coal trains carry 1,625 lbs. to the running foot. He has not the slightest doubt that if the coal traffic to Calcutta were carried in these capacious American cars, and if the coal was mechanically unloaded, as it should be, the railroads and the traders would never go back to the four-wheeled wagon. In America, cars are not cleaned out as carefully as in India, "and it was thought that the action of rain and moisture on the sulphurous coal would soon wear out the steel. I was able to tell them that experience in India with steel cars had not shown them to be excessively susceptible to danger from this cause."

Railroad Electrification Schemes in England.

The question of the substitution of electric traction for steam locomotives is much to the fore in England. The main cause of this is the great progress of electric surface tramways during the last few years and also of electric underground railroads in and around the metropolis. From this cause many of the steam railroad companies have lost a considerable portion of their suburban and interurban passenger traffic, whilst further losses are threatened as new "tube" and tram projects are carried into execution. As regards the suburban traffic of London, the existing railroad companies are looking to electric traction not only as a means of holding their own against new competition, but also as an aid to relieving the congestion at present felt on their lines within the busy hours of the morning and evening. In either case it is the more frequent service rendered economically practicable by electric traction which is regarded, with more or less confidence, as the recommendation of that system of haulage as superior to steam locomotives.

No electrification of a steam railroad has yet been carried into effect in England, but several schemes are in process of execution, whilst many others are talked of. The first to be completed will, no doubt, be the conversion of the Mersey Railway, which is being financed and carried out by the British Westinghouse Electric & Manufacturing Company, and which is expected to be ready for electric working at the beginning of 1903. This line, under the Mersey from Liverpool to Birkenhead, is only 4½ miles long, but was enormously costly to build. Since its opening in 1886, it has not done much more than pay working expenses, and a great part of its capital of over £3,000,000 has not received any dividends. The construction of electric tramways on both the Liverpool and Birkenhead sides of the river has lately made matters worse, as these trams work in conjunction with the ferries. Not much in the way of financial success can be expected from an undertaking so much overcapitalized.

The Metropolitan District Railway of London is also in process of electrification. In this case, again, the capital required for the conversion is being found from outside the existing company, viz., by the Speyer-Yerkes group, and the prospects of dividends being earned on the old stock are small. As is well known the Speyer-Yerkes syndicate are building a number of "tube" railroads in connection with the Metropolitan District system, and the identity of the latter is in danger of being lost amongst the new schemes. A small portion of the District system proper—between Ealing and Harrow—will be ready for electric working at the beginning of the new year, and here the servants of the company are to be trained for the general electrification, which is likely to take effect in about another year's time.

A more conclusive object-lesson of the advantages or otherwise of electrification for the urban and suburban traffic of London is likely to be afforded on the Metropolitan Railway which, like the District, has been driven to change its method of traction by the serious effects of the competition of the "Twopenny Tube." The Metropolitan owns a system of 73 miles, rather less than half of which is within the 12 miles radius which constitutes the Metropolitan area, whilst the rest stretches

out into, and beyond, the furthermost suburbs on the western side. The capital of the company is about £13,000,000 and the dividend paid for 1901 was at the rate of 2¼ per cent., which represents the low-water mark of this hitherto prosperous company's finances. The system is economically worked, the expenses representing only 51 per cent. of the gross receipts. It does not seem likely that this figure can be much improved by electric traction; indeed, it is already several points below the percentage proportions of the Central London and South London electric lines. But probably some of the traffic which the Metropolitan has lost to the "tubes" will be won back when the former is electrified, whilst a more frequent and more agreeable train service will no doubt attract additional passengers.

The electrification of surface railroads stands on a somewhat different footing from that of tunnels, inasmuch as the inducement to purify the atmosphere does not exist in the former case. Nevertheless, two English railroad companies, the North Eastern and the Lancashire & Yorkshire, have announced their intention to electrify sections of their systems in the neighborhood of large cities, where the competition of electric tramways is being severely felt. In both these schemes of electrification, as in those already referred to in this article, the "third-rail" system is to be adopted and steam locomotives and ordinary trains will pass over the "converted" lines.

The section of its system which the North Eastern Company has decided to electrify is a circular portion extending from Newcastle-on-Tyne back again to Newcastle-on-Tyne, and including the two lines which serve the populous townships on the northern bank of the Tyne, and also a stretch of seacoast around Tynemouth much favored both as a holiday and residential resort. It is intended to run lighter trains at much more frequent intervals, and the speed attained between stations will be much greater than that of the parallel electric tramways. No independent generating station is to be built as in the case of the other schemes already described, but the current will be drawn from the public supply. The lines to be converted under this scheme measure about 37 miles.

The Lancashire & Yorkshire Company's scheme comprises the line running from Liverpool to Southport, a distance of 18½ miles. Southport is a seacoast town much favored as a residential locality by Liverpool business men, and the line thereto passes through some of the most populous suburbs of the city. In this case a very frequent service is already run by steam locomotives, there being 85 trains each way daily between Liverpool and Crosby, whilst about half of these run the whole distance to and from Southport, many of them being expresses. The number of these latter is to be considerably increased under the electrification scheme, whilst as between Liverpool and Crosby—which comprises the suburban area—twice as many trains as before are to be run, the length of the trains being at the same time reduced by about one-half. The area covered by this suburban service is at the same time to be extended by about two miles, i. e., to the next station beyond Crosby. For the purposes of this conversion scheme a power station is to be erected at Seaforth, near Liverpool, and it is expected that this work and the provision of the rolling stock and other equipment will occupy about nine months. The new service may, therefore, be expected to be in operation before the end of 1903.

Yet another English, or rather Welsh, railroad company is understood to be about to convert one of its branch lines to electric traction, viz., the Taff Vale, one of the prosperous coal-carrying lines of South Wales, which also conducts a considerable passenger traffic in the colliery districts which it serves. Here, again, it is the competition, actual or prospective, of electric tramways which has turned the attention of the railroad authorities to electricity with the view of winning back, or safeguarding, their traffic. It has further been stated lately on good authority that the directors of the London & North Western have an electrification scheme in hand for a section of their road, but of this no details have yet been published.

So much for the schemes which are already in hand or have been decided upon. In addition to these, three other important companies—the Great Eastern, the London, Brighton & South Coast and the South Eastern & Chatham—have just given public notice that they intend to ask Parliament next session for powers to electrify the whole or any part of their undertakings. In the case of the London and Brighton route a scheme has just been advertised for constructing an electric express line between those two towns on the Behr mono-rail system—the system for which, it may be remembered, Parliamentary authority was obtained last year by the promotors of a new railroad between Manchester and Liverpool. The construction of this latter line is going forward, though very little work has yet been done on the ground.

The notice just issued by the Great Eastern, if it is anything more than a Parliamentary move with a view to the defeat of a "tube" railway scheme projected in the company's district, may be taken as indicating a scheme for converting the surburban lines of this railroad to electric traction. The suburban traffic worked by the Great Eastern in and out of Liverpool St. Station is probably the heaviest traffic of its class in the world, and it is handled in exceptionally long trains, consisting of 13 coaches and accommodating a maximum of 656 passengers. At the busy hours of the day these trains are worked at intervals of two minutes. The weight of one of these trains is about 210 tons, but with the new 10-wheeled locomotives recently built for the road an even greater weight than this could be handled. At the last shareholders' meeting of the company the chairman stated that they could not find either in England or America any electric railroad upon which such heavy trains were being operated with such frequency, and, although no doubt the thing could be done by electricity, he very much doubted whether it would be commercially successful.

As closely related to the subject of this article, it may be mentioned, in conclusion, that the North Eastern has lately announced its intention of running petrol-driven autocars in order to give a more frequent service on branch lines where stopping places are numerous. These cars which are under construction at the shops of the company, will be 53 ft. long and 13 ft. high, and will provide seating accommodation for 53 passengers each. At one end of the car there will be a Napier petrol engine of 85 h.p., with four cylinders; which engine will drive a dynamo generating electricity for two motors which will apply the power to the bogie under the engine compartment of the car. It is claimed that with these autocars a speed of 30 miles an hour will be attained in as many seconds, whereas it takes three minutes to get up the same speed with an ordinary steam train; and that there will be an equal saving of time in stopping. The autocars are to run in alternation with trains propelled by steam locomotives, and it is expected that they will prove very useful for service as special trains as well as in ordinary service where frequent light trains are wanted. In short, they possess many of the advantages of electric traction without the drawback of necessitating alterations in the permanent way.

London, Nov. 25, 1902. C. H. G.

Consolidation Locomotives for South America.

The Buenos Ayres Great Southern Railway are having built at the works of Messrs. Beyer, Peacock & Co., Limited, Manchester, England, a number of compound consolidation engines to be used in handling the heavy grain traffic on the grades at Bajo Hondo. They were designed by Robert Gould, Locomotive Superintendent of the road, and will be the first of that type to be used in the Argentine Republic, as well as the first broad gage, 5 ft. 6 in., consolidations in South America. The engines are two-cylinder compounds with cylinders 19 in. and 27½ in. by 26 in. stroke, with Allen-Richardson valves. Two of the engines will be fitted with piston valves for experimental purposes. The driving wheels have cast-steel centers and a diameter of 4 ft. 7½ in., the two middle pairs having blind tires. The rigid wheel base is 15 ft. 4 in., and the total wheel base, 24 ft. Of the total weight of the engine, 119,000 lbs., 101,000 lbs. is on drivers and 18,000 lbs. on the leading truck.

The boiler is of the Belpaire type, the inside diameter of the ring being 4 ft. 9 in. There are 234 1⅞ in. brass tubes, 12 ft. 3 in. long. The fire-box is of copper, 6 ft. 6¾ in. long by 3 ft. 11¾ in. wide with a grate area of 24.4 sq. ft. The heating surface is divided as follows: Tubes, 1409.3 sq. ft.; fire-box, 122.4 sq. ft.; total, 1531.7 sq. ft. The working steam pressure is 200 lbs.

The tender is carried on two four-wheel trucks, and will have a capacity of 5 tons of coal and 3,000 gallons of water with an estimated weight of 37 tons, loaded.

The first of these engines will soon be ready for shipment, and when once in service, the results will be watched with interest by South American railroad officials.

TECHNICAL.

Manufacturing and Business.

The Rand Drill Co. has increased its capital stock from $250,000 to $1,250,000.

H. S. Moulton, for several years past Superintendent of the Allison Mfg. Co. (car builders), Philadelphia, has severed his connection with the company.

John A. Granger has accepted a position with C. J. Harrington, dealer in machinery and general supplies for electric and steam railroads, with office at 15 Cortlandt street, New York City.

The Evans Car Coupler Co. has been incorporated in Illinois by Morris S. Evans and J. W. Wever, of Media, Ill.; Chas. Layman, of Washington, Iowa; E. O. Evans, of Burlington, and others.

The Harrison Dust Guard Co. is filling all Canadian orders from its plant lately fitted up at Montreal. F. E. Came is in charge of the company's affairs there, with offices in the Temple Building.

The Adlake acetylene gas lighting system made by the Adams & Westlake Co., Chicago, has been specified for 80 coaches now building for the Chicago, Burlington & Quincy by the American Car & Foundry Company.

F. W. Cox, heretofore Master Mechanic at the Milwaukee shops of the Chicago, Milwaukee & St. Paul, has resigned to become Superintendent with the Milwaukee Electric Company, makers of dynamos and motors.

The Thornton N. Motley Co., 12 John street, New York, as General Sales Agents of the Pittsburgh Spring & Steel Co., have secured an order for the springs for 1,000 steel cars for the Delaware, Lackawanna & Western, deliveries to be made in early spring.

At a meeting of the Board of Directors of the Pyle-National Electric Headlight Company, held on Thursday, the 18th inst., the regular semi-annual dividend of $2.50 per share was declared payable on the 31st inst. to the stockholders of record the 18th inst.

The Acorn Brass Manufacturing Co., Chicago, maker of miscellaneous brass castings and of the Acorn spray pump for white-washing and cold water painting, was burned out last Saturday. The loss of the company is reported at $60,000, and at this writing it is not known what insurance was held.

On Dec. 17 the company of Snare & Triest was incorporated under the laws of New York State; capital, $600,000; directors, Frederick Snare, W. G. Triest, of New York City, and H. M. Dunn, of Dongan Hills, Staten Island. The object of this corporation is for the purpose of increasing the facilities for handling a growing business.

Oliver C. Gayley, who for many years has been the General Agent of the Safety Car Heating & Lighting Co., has been appointed Manager of Sales of the Eastern District of the Pressed Steel Car Co., with headquarters in New York. Mr. Gayley is succeeded in the Safety Car Heating & Lighting Co. by Ernest F. Slocum. These changes take effect Jan. 20, 1903.

Mr. Duntley, President of the Chicago Pneumatic Tool Company, returned to Chicago, Dec. 15, from a trip abroad. He made arrangements there for the building of a plant at Fraserburg, in Aberdeenshire, Scotland, which will cost approximately $175,000. He also made arrangements with a German factory to make the Pneumatic Company's tools on contract.

The Western Iron & Steel Co., Chicago, recently incorporated, has leased and opened the Boughton foundry at Fortieth street and Union avenue and expect to begin immediately the manufacture of all-gray-iron castings, brake-shoes, etc. The main building is about 100 x 280 ft., and the plant will have a capacity of some 50 tons of castings a day. It is completely equipped with modern machinery, enabling the production of heavy work, and it is the intention of the company to make a specialty of heavy jobbing castings. M. R. McKinley, formerly of Rock Island, Ill., is Superintendent of the plant.

Iron and Steel.

A. S. Matheson, Third Vice-President of the National Tube Co., has resigned and the office will be abolished.

Charles T. Neale, a pioneer in the iron business in western Pennsylvania, died in Pittsburgh, Pa., Dec. 20, at the age of 70 years.

A director of United States Steel denies that the corporation has purchased the plant of the Troy Steel Company. He said it is not the intention to buy out any more plants.

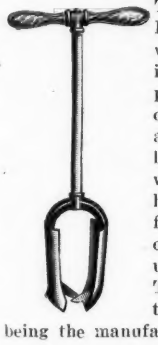
The N. & G. Taylor Co., of Philadelphia, largely interested in the Maryland Sheet & Steel Co., of Cumberland, Md., has leased that company's plant from Jan. 1, and it is said that improvements are to be made to increase the capacity.

It is said the Hoosier Drill Co., Richmond, Ind.; Empire Drill Co., Shortsville, N. Y.; Brennan & Co., Louisville, Ky.; Dowagiac Mfg. Co., of Dowagiac, Mich., and the Blickford & Huffman Co., of Macedon, N. Y., are to be consolidated into one company which will have a capitalization of $20,000,000 and headquarters in Springfield, Ohio. The Superior Drill Co. and P. P. Mast & Co., both of Springfield, are also included.

New Bolt and Nut Company.

The Southern Bolt & Nut Works of Birmingham, Ala., will consolidate with the American Bolt Company, of Lowell, Mass. The new company will build a modern plant in East Birmingham, Ala. C. H. Brill, of the American Iron & Steel Company, of Lebanon, Pa., is to be the superintendent. The company will make all sizes and kinds of nuts, track bolts, with rolled threads, as well as all kinds of machine and carriage bolts, heavy forgings, rods, etc.

An Effective Post Hole and Well Auger.



The accompanying engraving shows the Iwan post hole and well auger for which special advantage is claimed in boring holes for telegraph and telephone poles, and fence posts. It is claimed that ground conditions do not affect its working even though the soil be wet; also that there is no suction when the auger is withdrawn from the hole. It is said that two men can bore from 50 to 60 5-ft. holes a day with one of these tools; also that they are used by the United States Government. They are made in sizes ranging from 4 to 12 in., Iwan Bros., Streator, Ill., being the manufacturers.

Multiple Control Apparatus.

The Brooklyn Rapid Transit Company has given to the Westinghouse Electric & Manufacturing Company an important contract for multiple unit control apparatus. This is for the Westinghouse electro-pneumatic control, which has been in use on the Brooklyn Rapid Transit elevated system for some months. The further contract, therefore, has considerable significance.

A De Glehn Compound.

It is reported that a large compound on the De Glehn-Du Bousquet system is in course of construction at Bel-

fort for an English line, but no information is as yet available.

American Locomotive Company.

At a meeting of the Board of Directors of the American Locomotive Company the following officers were re-elected: S. R. Callaway, President; A. J. Pitkin, Vice-President; R. J. Goss, Second Vice-President; Leigh Best, Secretary; C. B. Denny, Treasurer, and C. E. Patterson, Controller. The earnings for the six months ending Dec. 31, 1902 (December partly estimated), were $15,265,352, an increase over same period in 1901 of $3,034,387. The company has now on its books orders for over 2,800 locomotives, and is increasing its shop capacity and buying new tools as rapidly as it is possible to have them built and delivered.

Signal Notes.

On Jan. 1, the Chicago, Milwaukee & St. Paul will begin the use of automatic block signals on its double-track line between Savanna, Ill., and Green Island. There are six block sections westbound and seven eastbound. The signals are semaphores, and distant signals are provided except in a few cases. Most of the distant signals are 3,000 ft. from the corresponding home signal. The signals change from clear to the stop position just before the engine reaches them, so that the engineman can see them operate. Switches have disk indicators. A train finding a home signal in the stop position must stop and wait one minute when, if the signal does not clear, the train may proceed under control.

The Boston Bridge Works has taken a contract for 10 signal bridges to be put up at points on the western division of the New York Central.

Bridge and Structural Steel.

A committee of the American Railway Engineering & Maintenance of Way Association has been instructed to collect information as to the requirements for bridge and structural steel. Bulletin No. 29 of the Association, which was issued last October, has a valuable compilation of opinions and practice on this subject. The Secretary of the Association has sent out a circular asking for specific information. Copies of the circular may be had from him, and replies should be sent to him. The Secretary is Mr. L. C. Fritch, Monadnock Block, Chicago, Ill.

Brick Arches.

The Traveling Engineers' Association has instructed a committee to report on the matter of brick arches in locomotive fire-boxes. The committee has sent out a list of 19 questions and asks that replies be sent to Mr. W. G. Wallace, Clinton, Iowa, care Chicago & North Western Railway.

Engine and Tender Brakes.

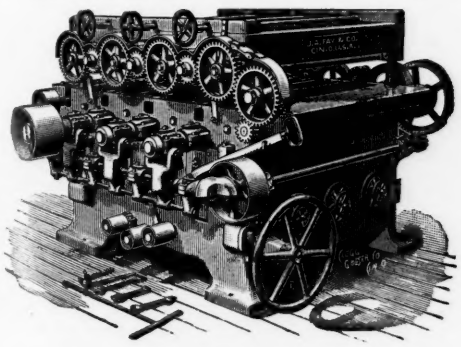
A committee of the Traveling Engineers' Association has been instructed to inquire into the question, "Is it desirable that freight and switch engines shall be equipped with straight and automatic brakes on engine and tender? What are the advantages and disadvantages?" A number of questions have been issued in a circular and it is requested that replies be addressed to Mr. Frank P. Roesch, 3774 Williams street, Denver, Colo.

Tunnel Franchise.

The Mayor of New York has signed the franchise for the Pennsylvania Railroad tunnel.

A New Sanding Machine.

The J. A. Fay & Egan Co. has a new design of sanding machine which is especially adapted to producing surfaces of great smoothness for painting or varnishing. It is heavily made and is capable of turning out a large amount of work. The three steel polishing cylin-



ders upon which the paper is placed have a vibratory motion to prevent the formation of lines, and are equipped with a device for applying the sand-paper quickly and giving it the proper tension. Each cylinder carries a different grade of paper, the third cylinder giving the final and smoothest finish. The feed is made very powerful and consists of eight feed rolls, four above and four below, driven by a train of heavy expansion gearing. These rolls will open to receive material 8 in. thick. The machine is made to work material from 30 to 80 in. wide, and has a brush attachment which cleans the stock after it has passed through the machine. The pressure rolls are arranged to enable quick, accurate and easy adjustment, and the starting and stopping of the feed instantly.

The Typewriter Morse Sender.

This ingenious machine, of which Mr. Charles E. Yetman, of 220 Broadway, New York, is the proprietor, is in use on the Pennsylvania Lines West of Pittsburgh and in the Associated Press offices in New York and Chicago. It is also used to some extent in Western Union, Postal and broker offices, mainly in New York city. Briefly described, it consists of a mechanical arrangement for transmitting Morse characters by merely touching typewriter keys; and by a simple turn of a lever the machine is instantly converted into a typewriter for receiving. In the typewriter the writing is "visible," the position of the paper when it is being struck being vertical, on the side of the roller facing the operator. Sheets (message blanks) for use in receiving are laid loosely in a trough, one at a time, and feed automatically, or nearly so. In sending, the quickness with which any single letter is made, as, for example, *p* is adjusted by a screw, a single adjustment fixing the quickness for all letters; and the speed of the sending; that is, the rapidity with which one letter shall succeed another—is limited only by the speed at which the sender can touch the successive keys, the same as the speed of a typewriter operator is limited. He does not have to hold the key down, and the touch is the same for a long character as for *e*. The speed of transmission is, of course, limited by the capability of the receiving operator.

THE SCRAP HEAP.

Notes.

It is announced that the general passenger agents of the trunk lines have decided to join the association for detecting ticket frauds.

On the Delaware, Lackawanna & Western news agents will hereafter be allowed in the cars only while trains are standing in terminal stations.

The suit in which the Erie Railroad resists the application of the law of the State of New York requiring the sale of mileage tickets at $20 for 1,000 miles, has been appealed by the company to the Supreme Court of the United States.

The Illinois Central is going to establish on Feb. 1 the office of Foreign Passenger Agent at New Orleans, and the first incumbent will be William Murray, heretofore Division Passenger Agent at the same city. The Division Passenger Agency will be taken by Mr. A. J. McDougall, now General Eastern Passenger Agent at New York City.

Press despatches say that the Cincinnati, New Orleans & Texas Pacific has made a general increase in the wages of employees, dating from Dec. 1. The rate of increase is from 5 to 10 per cent. A similar announcement concerning the Ann Arbor Railroad says that the increase will be from 5 to 7 per cent., and will make a total of 10 per cent. during the present year.

At the last meeting of the Central Traffic Association a resolution was passed recommending the entire abolition of skeleton tickets after the end of January next. Skeleton forms of coupon tickets are most easily manipulated by scalpers. In many instances the entire writing will be effaced and new route and destination inserted. A number of ticket offices throughout the country have been robbed and skeleton tickets stolen. In such cases it is almost impossible to properly bulletin such tickets on account of the ease with which they can be manipulated and changed.

The Interstate Commerce Commission took testimony in New York last week in the investigation which the commission has begun concerning the reasonableness of the freight rates from New York to the West on goods imported from Europe. On some commodities the import rate to Chicago is 18 cents, while the rate to the same city on domestic shipments is 65 cents. It was pointed out, however, that the low rate is made in competition with lines from European ports by water to New Orleans and thence by rail northward, and that the New Orleans route gets about all of the traffic in any event. A steamship agent said that some of the commodities concerning which complaint was made were sometimes taken by the vessels for nothing, as the weight was needed for ballast; and they even paid for the privilege occasionally.

A Washington despatch of Dec. 21 says that Mr. Bacon is thoroughly discouraged over the situation in Congress in regard to the proposition to pass laws increasing the powers of the Interstate Commerce Commission. Senator Elkins appointed a meeting of his committee to discuss the subject and Mr. Bacon personally secured solemn pledges from each of the 13 members of the committee to attend the meeting, but only two of them were actually present. This incident must have tended strongly to convince Mr. Bacon that 13 is a very unlucky number. The correspondent of the New York *Journal of Commerce*, who tells of these things, says: "It is learned that railroad interests have given distinct notice that they do not wish to have the law amended at this time, and that their wishes will be obeyed, certainly during the current session, notwithstanding the desire of the small competitive shippers of the country and of the Interstate Commerce Commission."

The hearing on the freight rate injunctions at Chicago last week appears to have been without important result. The court asked the lawyers to submit printed briefs and that means a delay of several weeks. Counsel for government argued that the government had the right to appeal to a court of equity where a public wrong was being committed. Discrimination in freight rates wronged so many shippers that the wrong became a public one; government intervention was the only possible remedy. Counsel of the railroads contended that in the Debs case, cited by the prosecution, transportation of the mails was interfered with and that the government being thus directly injured naturally had the right to invoke the aid of the courts. The present case is not parallel; the government is not a shipper, has not sustained any injury, and has no pecuniary interest in the matter, and therefore has no right to bring suit. Attorney Dunlap reminded the court that the granting of injunctions would deprive the defendants of the constitutional right of a trial by jury.

Some of the Things the G. M. Must Think About in Asia.

The Asiatic Midland Railroad, in the Russian Trans-Caspian dominions, has a considerable expenditure charged to "schools" and another to "churches." Long stretches of the road pass through an uninhabited country; and the population in the rest of it is Mahommedan Naturally, good orthodox railroad men from Russia object to bringing their families where they will find neither church nor school. They would not be worth their salt if they didn't. Therefore churches and schools were established, and the attendants are carried to them from outlying stations. Another special requirement on this railroad was accommodation for Mohammedan women. There are millions of Mohammedans in European Russia, but most of these have become so demoralized by living among the infidels that they suffer their women to be looked at unveiled. This may not be endured in Trans-Caspia, and every train has a special third-class car where no male being need apply, and the wives of the faithful are carefully defended against all prying eyes.

Deer Guards.

Cattle-guards have been changed in form to prevent deer from running over them, and that, of all places in the world, in the suburbs of Berlin. It had been found that where the railroad passed for a considerable distance through woods, deer would run along the track and over the standard cattle-guards into station yards, where some had been killed by switching trains. By laying iron slats instead of wooden ones, about 1½ in. apart, the deer could not run through the yards, but unless the guards were more than 13 ft. long they might leap over them.

The New Harbor at Vera Cruz in Mexico.

The formal opening of the new harbor of Vera Cruz occurred last spring of this year. The construction of the harbor required about 2,200,000 tons of masonry and concrete, 8,500,000 cu. yds. of sand excavation, and 65,000 cu. yds. of rock excavation. The total cost of the work amounted to 30,000,000 Mexican dollars.

The work consisted in creating a closed harbor of 545 acres and in reclaiming 247 acres for the construction of streets, storage buildings, public buildings, etc. A general depth of 27.6 ft. below low water level has been obtained for the harbor with a depth of 33 ft. in the entrance channel and along the main pier. The total length of the dams enclosing the harbor, including the breakwaters, is 10,800 ft. The landing frontage consists of 2,200 ft. of deep pier front, 3,900 ft. of steel and timber piers and 10,900 ft. of masonry quay walls.

The trade of the Vera Cruz harbor in the year 1900-1901 was as follows:

	Imports.	Exports.
Long distance shipping.....	381,000 tons	48,500 tons
Coast shipping	29,000 "	35,000 "
Railroad traffic	290,000 "	300,000 "
Total	700,000 tons	113,500 tons

Disastrous Rear Collision at Byron, Cal.

On the night of Dec. 20 the southbound night express over the Southern Pacific from San Francisco to Los Angeles was run into at the rear by the following "Stockton flyer" at Byron, Cal., 63 miles from Oakland, and 23 persons, mostly passengers, were killed. Many others were injured.

The Uganda Railroad.

The official estimate of the final cost of the building and equipping of the Uganda Railroad is £5,449,036. The road is 584 miles long: the cost, therefore, is about $46,000 a mile. It is narrow gage and of comparatively light construction and very lightly equipped. In the year to March 31, 1901, an average of 508 miles was worked, and working expenses absorbed 94 per cent. of the gross earnings. This percentage will be much higher when there is no credit for carrying construction material.

Two Good Performances.

Press despatches of Dec. 22 report that the Pennsylvania's New York-Chicago special ran from Crestline to Fort Wayne, 131 miles, in 123 minutes, including four full stops; and that the "Twentieth Century Limited" on the Lake Shore ran from Toledo to Elkhart, 134 miles, in 127 minutes.

The Proposed Department of Commerce.

After several meetings at which representatives of the different Government departments interested were heard in regard to what bureaus should be transferred to the new Department, the Committee on Interstate and Foreign Commerce of the House of Representatives on Dec. 19 by a vote of 5 to 3 ordered a favorable report on the bill passed by the U. S. Senate last session, the report to be made after the holiday recess. There are a number of amendments to the bill as passed by the Senate, and the bureaus transferred to the new Department as agreed upon by the House Committee are: The Lighthouse Board and Lighthouse Service; National Bureau of Standards; U. S. Coast and Geodetic Survey; Immigration Bureau, including jurisdiction over the enforcement of the Chinese exclusion act; Bureau of Statistics; Census Office; Department of Labor; U. S. Fish Commission; Foreign Commerce Bureau of the State Department, and the three new Bureaus of Manufactures, Insurance and Corporations.

Electrical Engineers Wanted.

The U. S. Civil Service Commission will hold an examination on Jan. 20 and 21 next for the position of electrical engineer in the U. S. Signal Corps. It is desired to appoint one person at a salary of $2,000 a year, one at $1,600 and one at $1,400.

The Pennsylvania's Improvements at West Philadelphia.

On the first of March of next year the new interchange station of the Pennsylvania Railroad at Thirty-second and Market streets, will be opened to the public, and with this move the entire outgoing and incoming traffic at Broad Street Terminal will be changed. Since the early part of last year there has been a constant activity in the West Philadelphia yards, tunnelling, bridging and tracking. The monster task of laying out the big railroad yards so as to make that section the pivotal point of western and southern travel, was begun in January, 1901. Chief Engineer Brown was assigned the work of making the plans, and after this contracts were made with John Gall & Co., P. McManus, Sparks & Evans, the

Drake & Stratton Co., and the Pennsylvania Steel Company to execute the ideas set forth by Engineer Brown.

Three tunnels have been dug, two bridges have been erected, a handsome station has been built, two new elevated lines have been constructed and hundreds of miles of new tracks have been laid. It is estimated that the work will cost $5,000,000, and all for the purpose of expediting travel and saving time. Several thousand men are now employed in finishing the task, and if clear weather prevails, the entire job should be ended in another two months.

All trains, whether local or express, will stop at Thirty-second street, and the old station at Powelton avenue will be done away with. The trains bound south from New York will not pull into Broad Street Station as they are doing to-day, but will take on passengers at the new interchange station. They will use the New York Division tracks only as far as the Zoological Garden and here switch on to a new line and connect with the Philadelphia, Baltimore & Washington by means of a tunnel at Thirty-second street. New York express trains [for Philadelphia] and trains coming in over the main line will use a new set of tracks now being laid on an elevation, and they will cross the Schuylkill River on the new bridge now being completed. Trains from Washington and the south bound for Philadelphia will have the exclusive use of the bridge at present employed by all divisions. The center bridge, crossing the Schuylkill, and the lines of track lying between the Philadelphia, Baltimore & Washington tracks and the New York and main line tracks will then be used only for hauling empty cars and making up passenger trains, thereby taking off a great deal of traffic from the lines employed by running trains.

Express trains from New York to Pittsburgh, Chicago and the West will only stop at Germantown Junction, and by means of the new tunnel run direct to the main line without coming into Broad Street Station or Thirty-second street. This will act as a great relief to Broad Street Terminal and enable the company to put on many new express trains to the west and south. It will give to Philadelphia a much better service, as the time schedule will be enlarged. Trains for the west and south may then be taken not only at Broad Street Station, but also at Germantown Junction and Thirty-second street.

The new West Philadelphia Station is a "double-decker." Passengers bound for New York and the west will use the upper platform and those going to Washington and the south will employ the lower one.—*Philadelphia Telegraph.*

LOCOMOTIVE BUILDING.

The Baltimore & Ohio is having 87 locomotives built at the Richmond Works of the American Locomotive Co.

The Louisiana & Arkansas has ordered eight 10-wheel simple locomotives from the Baldwin Locomotive Works, for August, 1903, delivery. The locomotives will weigh 139,000 lbs., with 110,000 lbs. on the drivers, and have 20 x 26 in. cylinders, 56 in. drivers; extended wagon top boilers, with a working steam pressure of 180 lbs.; 291 iron tubes, 2 in. in diameter and 13 ft. long; fire-box of steel 108 1/16 in. long and 33⅜ in. wide; tank capacity 5,000 gallons of water and 20,000 lbs. of coal. The special equipment includes: Westinghouse air-brakes, Baldwin axles, Shickle, Harrison & Howard couplers, Adams & Westlake headlights, Monitor injectors, Jerome piston and valve rod packings, Crosby safety valves, Leach sanding devices, Detroit sight-feed lubricators, French springs, Crosby steam gages and standard driving, truck and tender wheel tires.

The Long Island has ordered eight locomotives from the Baldwin Locomotive Co.; four simple 10-wheel locomotives; two 6-wheel switch locomotives, and two Consolidated locomotives, all for April, 1903, delivery. The 10-wheel locomotives will weigh 175,000 lbs., with 137,600 lbs. on the drivers; 20 x 26 in. cylinders; 72 in. drivers; wide fire-box boilers; with a steam pressure of 200 lbs.; 339 iron tubes, 2 in. in diameter and 14 ft. 11 in. long; fire-box of steel 113¼ in. long, and 95¼ in. wide; tank capacity 5,000 gallons of water, and 10 tons of coal. The 6-wheel switch locomotives will weigh 123,000 lbs., all on the drivers; diameter of cylinder, 19 in.; 51 in. drivers; straight, narrow fire-box boilers, with a steam pressure of 200 lbs.; 270 iron tubes, 2 in. in diameter, and 10 ft. 11⅝ in. long; fire-box of steel, 103⅛ in. long, and 33¼ in. wide; tank capacity 4,000 gallons of water, and five tons of coal. The two Consolidated locomotives will weigh 163,000 lbs., with 142,000 lbs. on the drivers; diameter of cylinder, 21 in.; 51 in. drivers; wide fire-box boilers, with a steam pressure of 200 lbs.; 322 iron tubes, 2 in. in diameter, and 11 ft. 7 3/16 in. long; fire-box of steel, 119⅛ in. long, and 85½ in. wide; tank capacity 5,000 gallons of water, and 10 tons of coal. The special equipment for all will include: Westinghouse air-brakes; Steel-Midvale axles; Gollmar bell-ringers; Standard couplers; Star headlights; Sellers & Monitor injectors; U. S. metallic piston rod and valve rod packings; Consolidated safety-valves; Leach sanding devices; Detroit sight-feed lubricators; Crosby steam gages; Latrobe driving wheel and tender wheel tires; cast-steel wheel centers for the 10-wheel and Consolidated locomotives, and cast-iron for the 6-wheel switch locomotives.

The Southern Pacific has ordered 66 locomotives from the Baldwin Locomotive Works, 18 compound mogul and ten 10-wheel passenger locomotives, for July, 1903, delivery; 13 Atlantic compound passenger locomotives, for June, 1903, delivery, and 25 simple switching locomotives, for August, 1903, delivery. The mogul locomotives will weigh 171,000 lbs., with 145,000 lbs. on the drivers; the 10-wheel locomotives will weigh 185,000 lbs., with 145,000 lbs. on the drivers. Both mogul and 10-wheel locomotives will have 15 x 26 in. cylinders, 63 in. drivers; wagon top boilers, with a working steam pressure of 200 lbs.; the mogul locomotives will have 308 tubes; the 10-wheel locomotives 344 tubes, 2 in. in diameter, 13 ft. long; fire-box 108 in. long and 66 in. wide; tank capacity 6,000 gallons of water and 10 tons of coal. The Atlantic locomotives will weigh 192,000 lbs., with 109,000 lbs. on the drivers, and have 15 and 25 x 28 in. cylinders, 84¼ in. drivers; Vanderbilt boiler for oil burning, with a working steam pressure of 200 lbs.; heating surface of 3,193 sq. ft., 185 tubes, 16 ft. long; fire-box 110 in. long and 63½ in. wide; grate area, 47.41 sq. ft.; tank capacity 7,300 gallons of water and 3,300 gallons of oil capacity. The switching locomotives will weigh 130,000 lbs., and have 19 x 26 in. cylinders, 57 in. drivers, 20 boilers to be built for coal burning and five for oil burning, with a working steam pressure of 180 lbs.; heating surface of 1,842 sq. ft., 200 tubes, 2 in. in diameter, 12 ft. 6 in. long; fire-box 108 in. long and 51 in. wide; grate area, 30.2 sq. ft., and tank capacity 3,700 gallons of water. The special equipment for all will include: Franklin boiler lagging, Sargent Diamond "S" brake-shoes, Buck headlights, Monitor injectors, Cypress-Bronze journal bearings; U. S. piston and valve rod packings; Baltimore sanding devices; Nathan sight-feed lubricators and standard driving, truck and tender wheel tires.

CAR BUILDING.

The Chicago, Rock Island & Pacific is in the market for 5,000 box cars.

The New York, Philadelphia & Norfolk is having 150 freights built by the Pressed Steel Car Co.

The Chicago, Milwaukee & St. Paul is having two coaches built by the Barney & Smith Car Co.

The Great Northern has placed orders with the American Car & Foundry Co. for 300 to 500 oil cars.

The Indianapolis Abattoir Co. has ordered 35 refrigerator cars from the American Car & Foundry Co.

The California & Northwestern has ordered 30 box and 20 flat cars from the American Car & Foundry Co.

The Georgia, Florida & Alabama has ordered 25 flat cars and two coaches from the American Car & Foundry Co.

The New York, New Haven & Hartford is having 1,000 freights built at the Berwick Works of the American Car & Foundry Co.

The Hicks Locomotive Co. has orders for rebuilding freight cars for the following companies: Columbus & Southern, Toledo & Indiana.

The Mobile, Jackson & Kansas City writes that it is not in the market for any equipment, and that it will build its own cars at the shops at Frascati.

The New York, Ontario & Western has ordered 200 box cars of 80,000 lbs. capacity from the South Baltimore Car Co., for February to March, 1903, delivery. The cars will be 36 ft. long, 8½ ft. wide, and 8 ft. high inside measurement, with wooden underframes. The special equipment includes: Gould axles; Laffin steel back brake-shoes; Westinghouse brakes; Brady brasses; Gould couplers; Hennessey friction gear draft rigging; Symington journal boxes and lids; Murphy outside roofs; Railway Steel Spring Co.'s springs; N. Y., Ontario & Western standard diamond trucks.

The Evansville & Terre Haute has ordered 250 38-ft. wooden box cars, of 80,000 lbs. capacity, from the Pullman Co., for April, 1903, delivery; and 100 40-ft. wooden flat cars, of 80,000 lbs. capacity, from the American Car & Foundry Co., for February, 1903, delivery. The special equipment includes: Bettendorf brake-beams on box cars, Dexter brake-beams on flat cars, Westinghouse air-brakes, National Railway Specialty Co.'s brasses, Tower couplers, Dunham door fastenings on box cars, Miner draft rigging, McCord journal boxes and lids, Railway Steel Spring Company's springs.

The Southern Pacific, as reported in our issues of Dec. 5 and 19, has ordered 1,600 box cars of 80,000 lbs. capacity, and 500 stock cars of 60,000 lbs. capacity from the Western Steel Car & Foundry Co., for March to July, 1903, delivery, and 1,000 pressed steel flat cars of 80,000 lbs. capacity from the Pressed Steel Car Co., for March, 1903, delivery. The box and stock cars will measure 36 ft. long. The flat cars will measure 40 ft. long and 9 ft. 5¾ in. wide. All cars to have pressed steel underframes. The special equipment for all includes: Simplex bolsters, company's pattern brake-beams, Brady brasses, Tower couplers, Miner draft rigging and arch bar rigid trucks.

The Missouri, Kansas & Texas has ordered 800 box, 500 combination stock and coal cars of 60,000 lbs. capacity and 100 side dump and 100 flat cars of 80,000 lbs. capacity from the American Car & Foundry Co. The dump and flat cars are for February and March, 1903, delivery. The box cars will weigh 31,100 lbs. and measure 36 ft. 10½ in. long, 9 ft. 1 in. wide and 8 ft. high. The combination cars will weigh 35,600 lbs., and measure 36 ft. 3½ in. long, 8 ft. 5½ in. wide and 7 ft. 1¾ in. high. The dump cars will weigh 28,900 lbs., and measure 36 ft. long, 8 ft. 10¼ in. wide, over side sills, and 3 ft. high, inside measurement. The flat cars will weigh 25,150 lbs., and measure 36 ft. long, 9 ft. 3 in. wide and 4 ft. 1¾ in. high to top of floor. All cars to be built of wood, with wooden underframes. The special equipment for all includes: Carnegie steel axles; American Steel Foundries' bolsters, except 500 box cars to have Commonwealth Steel Co.'s bolsters; National-Hollow brake-beams; Diamond "S" brake-shoes; National-Fulton Brass Manufacturing Co.'s brasses; Buckeye Malleable Iron & Coupler Co.'s couplers on the box and combination cars, and Trojan couplers on the dump and flat cars; Security side door fixtures on the box and combination cars; Miner draft rigging; American dust guards; McCord journal boxes and lids; Sherwin-Williams paint; Chicago-Cleveland Car Roofing Co.'s roofs on box and combination cars; Railway Steel Spring Co.'s springs; Player trucks, and American Car & Foundry Co.'s wheels.

BRIDGE BUILDING.

ALBION, IND.—James T. Johnston, Bridge Engineer, can give information about the six steel leg girder bridges to be built by Noble County, and for which bids are wanted Jan. 6 by Thomas A. Huston, County Auditor.

ARKADELPHIA, ARK.—It is said that the Converse Bridge Co., of Chattanooga, Tenn., will make the plans and specifications for the new bridge to be built over the Ouachita River at Arkadelphia. It is to be a steel structure and cost about $25,000.

AUGUSTA, GA.—The U. S. Senate on Dec. 16 passed the bill authorizing a bridge across the Savannah River at Sand Bar Ferry, below Augusta, Ga. (Dec. 19, p. 970.)

BANGOR, ME.—The Bangor City Council failed to make any decision in regard to the matter of apportioning the cost of the proposed bridge between Bangor and Brewer. It is to be a free highway bridge and the County Commissioners are expected to pay part of the cost.

BECKLEY, W. VA.—See Deepwater Railway Co., under Railroad Construction.

BLACK ROCK, ARK.—One steel bridge and two trestles are wanted on the line of the Arkansas & Northern. J. H. Myers, Black Rock, Ark., is President.

BLOOMFIELD, IND.—Bids are wanted Jan. 6 for a 100-ft. steel bridge; also for a 40-ft. steel bridge. Harvey L. Doney, County Auditor.

CHICAGO, ILL.—It is said the Chicago City Ry. Co. has offered to build a bascule bridge in place of the present Archer avenue bridge, provided the city take the cost out of the compensation demanded for the franchises.

DENVER, COLO.—Bids are wanted Jan. 15 for about 30 bridges on a new county road. The longest structures are 100 ft. John E. Ramer, County Clerk.

DETROIT, MICH.—The Comptroller of the city of Detroit is advertising for proposals for a site for the approach to the proposed bridge over the American channel of the Detroit River to Belle Isle.

Mr. Hayes, President of the Grand Trunk, is reported as saying that it may not be long before a railroad bridge will be built over Detroit River.

HARRISBURG, PA.—The Commissioners appointed by the Dauphin County Court have recommended a bridge at the State's expense across the Schuylkill River near Auburn, at a cost of $10,000.

HAVRE DE GRACE, MD.—There is no truth in the report that the B. & O. or Pennsylvania roads are to build a new bridge over the Susquehanna near Havre de Grace, as persistently reported.

KENTUCKY.—A bill was introduced in the House of Representatives on Dec. 16 authorizing the Norfolk & Western Ry. to build a bridge across Tug Fork of the Big Sandy River at points where it forms the boundary line between Kentucky and West Virginia.

MILWAUKEE, WIS.—The committee on bridges has rejected the bid of $93,000 of the Milwaukee Steel Structural Company for the Muskego avenue bridge because it is considered too high.

MINDEN, NEB.—Bids are wanted Jan. 14 by Chas. Swanson, County Clerk, for building all bridges needed in Kearney for one year from Jan. 14, 1903.

NEW YORK, N. Y.—The New York Central has an ordinance before the city for changes above the Grand Central station on Park avenue, necessitating a number of bridges.

OSHKOSH, WIS.—Plans are being made for a new bridge over Sawyer Creek and bids may be wanted soon. G. H. Randall, City Engineer.

PARKERSBURG, W. VA.—It is said that the Parkersburg Bridge & Terminal R. R. Co. has secured options on the necessary property near the foot of Fourth street for the approach to its bridge. J. T. Blair, of Greenville, Pa., is interested.

PLAINWELL, MICH.—A. L. Nichols, County Supervisor, announces that a special election is about to be held to vote on a proposition to raise money for a new bridge.

RAPID CITY, S. DAK.—The Federal R. R. will probably let contracts soon for the two steel bridges needed on its line. Wm. M. Wright, Chief Engineer.

ST. CHARLES, MO.—A bill has been introduced in the U. S. Senate authorizing a bridge across the Missouri River within 10 miles of the corporate limits of St. Charles, in St. Charles and St. Louis Counties, Mo., the bridge to be a post route.

SCRANTON, PA.—Bids will be opened Jan. 12 in the City Recorder's office for building the viaduct along West Lackawanna avenue from Seventh avenue to Ninth avenue, crossing the Delaware, Lackawanna & Western tracks. The plans are on file with the Department of Public Works and each bidder must file a certified check for $1,000 with his bid. Joseph P. Phillips, Chief Engineer.

The new bond ordinance, which will shortly be favorably reported in Common Council, provides for the following new bridges: At Race street, at Washington avenue, over the Lackawanna tracks at Meridian street, over Mattes street, at Ash street, wing wall at Carbon street bridge and abutments for Green Ridge street bridge.

SIOUX CITY, IOWA.—We are told that nothing has been done in regard to building the proposed viaducts on Iowa or Wall streets. It will take about a year to complete plans and negotiations with the railroad companies.

TACOMA, WASH.—Bids are wanted Jan. 12 for building a 350-ft. bridge over a gulch.

Bids are wanted Jan. 15 for building the draw bridge over Puyallup River. It is 240-ft. span. (Dec. 19, p. 970.)

TAYLORSTOWN, PA.—The Baltimore & Ohio will not build a stone bridge over Buffalo Creek at a cost of $50,000, as reported by a number of papers.

TYRE, N. Y.—The Seneca County Board of Supervisors has authorized this town to borrow $1,800 for building a bridge over Black Brook.

WALNUT GROVE, CAL.—Bids will probably be wanted in January for the 200-ft. draw span bridge over Mokelumne River on the county line. The cost will be about $20,000. J. C. Boyd, County Surveyor, Sacramento.

WESTMORELAND, KAN.—Bids are wanted until Jan. 10 by the Board of Commissioners for two 40-ft. steel span bridges and one 50-ft. span. A. P. Scritchfield, County Clerk.

YANKTON, S. DAK.—Bids are wanted until Jan. 6 by the County Auditor for building all county bridges and making all repairs needed during the year 1903.

Other Structures.

ALBION, MICH.—The Jackson-Battle Creek Traction Co. is reported to have secured a site just west of the city limits where it will build large car barns, repair shops, etc.

CLEVELAND, OHIO.—The Bedford Steel Co. will begin work Feb. 1 on its proposed plant in Bedford Township along the Pennsylvania R. R.

CUMBERLAND, MD.—The Cumberland Cement Co. has just started building a new cement plant about seven miles from Cumberland at a cost of $500,000.

DENISON, TEXAS.—Bids are being received until Jan. 17 for the new roundhouse in this city for the Houston & Texas Central. Plans are with C. C. Calvert, Agent.

FORT WAYNE, IND.—Local reports state that the Wabash shops are to be enlarged at once. A new building to be put up between the machine and blacksmith shops will be 80 x 40 ft., two stories high.

HELENA, MONT.—The contract for building the new union passenger station for the Northern Pacific and Great Northern roads at Helena has been let to Geo. S. Deeks & Co., of St. Paul. It is understood the price is $50,000.

LONG ISLAND CITY, N. Y.—Fire on the night of Dec. 18 destroyed the passenger terminal of the Long Island

R. R. in Long Island City, causing a loss of about $85,000.

LOS ANGELES, CAL.—It is said the Southern Pacific car and machine shops in East Los Angeles will be doubled in size, making each building 493 ft. long.

LOUISVILLE, KY.—The Monon road, according to report, will build a large freight depot at Main and Fourteenth streets in the spring.

SANDWICH, ONT.—The Canadian Pacific is said to be considering building some large ships for service on the Great Lakes and will, it is also said, establish a plant at Sandwich, where these ships will be built and all repairs made.

SYDNEY, NOVA SCOTIA.—The Dominion Iron & Steel Co. will make an addition to its plant at Sydney at a cost of $800,000. It is to be a rail mill and will probably be in operation within six months. A contract for some of the work has been let to Tannet, Walker & Co., of Leith, Eng.

THREE RIVERS, MICH.—The Fairbanks-Morse Co. will build a new foundry at Three Rivers, and Stevens & Blume, architects of Detroit, will probably let the contracts next month. The building will be 250 x 90 ft.

TUCSON, ARIZ.—The California Iron & Steel Co. has been incorporated in Arizona by J. C. Hunter, R. W. McGarvie and O. K. Fitzsimmons. The principal branch office will be at Los Angeles, Cal.

WEEDSPORT, N. Y.—The Weedsport Construction Co. will build a plant adjoining the tracks of the New York Central and Lehigh Valley Railroads to make steel bridges. W. A. Whiteman is interested.

WILMINGTON, DEL.—The Pennsylvania has let a contract to Armstrong & Printzenhoff, of Philadelphia, for building a 30-stall brick roundhouse at the Shellpont shops.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

New York Railroad Club.

Mr. F. M. Whyte, Mechanical Engineer of the New York Central & Hudson River Railroad, New York city, has been appointed Secretary of the club in place of Mr. W. B. Yereance.

The Rocky Mountain Railway Club.

At the regular monthly meeting, Saturday evening, Dec. 20, a paper entitled "Rate Making and Its Causes," by Mr. C. L. Wellington, General Traffic Manager of the Colorado & Southern Railway, was presented and discussed.

PERSONAL.

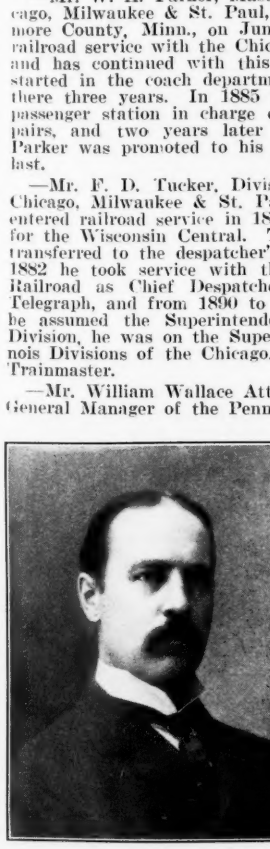
—Mr. George P. Paradis, who has been appointed Engineer of Maintenance of Way of the Illinois Southern, was born at Burlington, Vt., and was educated at the University in that city. He was rodman and locating engineer for the Chicago Terminal Transfer Railroad, later going to the Wisconsin & Michigan as Superintendent of grading, where he remained until 1891. Mr. Paradis received his appointment on the Illinois Southern on Dec. 1, this year.

—Mr. Eliot Sumner, Assistant Engineer of Motive Power of the Buffalo & Allegheny Division of the Pennsylvania Railroad, was born in 1873. After graduating from Yale College in 1896, he entered the service of the Pennsylvania Railroad and has been with this company ever since. In September, 1896, he was made special apprentice, then in February, 1901, he became inspector of the West Philadelphia shops, and the following October he was made Assistant Master Mechanic, from which position he was recently promoted to that above named.

—Mr. W. A. Parker, Master Car Builder of the Chicago, Milwaukee & St. Paul, was born in Lenora, Fillmore County, Minn., on June 28, 1857. He began his railroad service with the Chicago, Milwaukee & St. Paul and has continued with this company ever since. He started in the coach department in 1882 and remained there three years. In 1885 he was transferred to the passenger station in charge of passenger equipment repairs, and two years later he became foreman. Mr. Parker was promoted to his new position in November last.

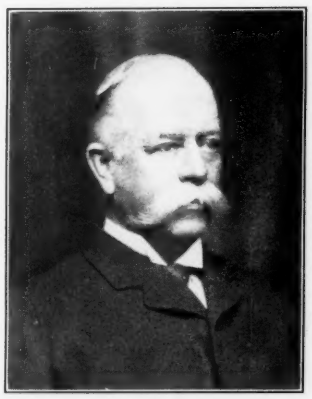
—Mr. F. D. Tucker, Division Superintendent of the Chicago, Milwaukee & St. Paul, was born in 1863 and entered railroad service in 1880 as a telegraph operator for the Wisconsin Central. The following year he was transferred to the despatcher's office at Milwaukee. In 1882 he took service with the Milwaukee & Northern Railroad as Chief Despatcher and Superintendent of Telegraph, and from 1890 to December this year, when he assumed the Superintendency of the James River Division, he was on the Superior, Kansas City and Illinois Divisions of the Chicago, Milwaukee & St. Paul as Trainmaster.

—Mr. William Wallace Atterbury has been appointed General Manager of the Pennsylvania Railroad, to take effect Jan. 1. He is appointed General Manager from the office of General Superintendent of Motive Power, which he has held since Oct. 1, 1901. We reproduce some notes of his railroad career from our issue of Oct. 11, 1901, and also a portrait which appeared in that issue. Mr. Atterbury is 36 years old and was born at New Albany, Ind. His railroad life dates from 1886, in which year he graduated from Yale (Sheffield Scientific School). He began with the Pennsylvania Railroad as an apprentice and for three years was assistant road foreman on various divisions. In 1892 he became Assistant Engineer of Motive Power of the Pennsylvania Lines (Northwest System), where he remained one year, later becoming Master Mechanic at Fort Wayne, Ind., for the Pennsylvania Company. He discharged these duties until 1896, and from then until Oct. 1 last year he was Superintendent of Motive Power of the Pennsylvania Railroad Division of the Pennsylvania Railroad, and from that date until now he has been General Superintendent of Motive Power, Pennsylvania Railroad.



—Mr. J. F. Deems has been appointed General Superintendent of Motive Power of the New York Central & Hudson River Railroad. This is understood to cover not only the N. Y. C., but also the Lake Shore, the Lake Erie & Western, the Indiana, Illinois & Iowa, and the Pittsburgh & Lake Erie. This does not make any change in the position now held by Mr. A. M. Waitt, who is Superintendent of Motive Power and Rolling Stock of the New York Central & Hudson River Railroad. Last February Mr. Deems resigned the position of Superintendent of Motive Power of the Chicago, Burlington & Quincy to become General Superintendent of the American Locomotive Company at Schenectady. We reprint here the short sketch of his life which we published at that time, and also reproduce his portrait from a photograph. Mr. Deems's advancement on the Burlington has been rapid and his success in shop organization and in handling men has attracted much attention. It is generally known that Mr. Deems has been offered several fine positions during the past year, and it has only now been settled which he would take of three places recently offered. All involved large responsibility and were fine fields for a broad man of ability and energy. Mr. Deems was born in 1856 in Washington County, Pa., and graduated at the Southwestern Institute of Pennsylvania. During the time he attended college he taught school at odd times beside doing some teaching in the institute. His first railroad work was with the Baltimore & Ohio as special apprentice and machinist. He then took service with the Chicago, Burlington & Quincy at Beardstown, and, after working eight months as a machinist, he was made foreman of a gang and later roundhouse foreman. He was then transferred to a similar place at Galesburg, was next made General Foreman at Beardstown; then Master Mechanic at Ottumwa; Master Mechanic at Beardstown, and Master Mechanic at the Burlington shops. In April, 1900, Mr. Deems was appointed Assistant Superintendent of Motive Power, with headquarters at Burlington, and the following June he became Superintendent of Motive Power, with offices at Chicago.

—Mr. Joseph Baldwin Hutchinson, General Manager of the Pennsylvania Railroad, becomes Assistant to the Second Vice-President on Jan. 1, but he will take four months leave of absence before assuming his new duties.



Mr. Hutchinson has been almost 40 years in the service of the Pennsylvania Railroad and has been General Manager for nearly six years. He has earned an easier berth and is a wise man to take it and a fortunate man to have the opportunity. He was born in Bristol, Pa., on Wednesday, March 20, 1844, and after a preparatory education entered the Polytechnic College of Pennsylvania, graduated in 1861. Upon his graduation, in order to perfect himself more thoroughly in the knowledge of machinery and applied mechanics, he entered the Delamater Iron Works in the City of New York in the spring of 1862, and continued there until the fall of that year, when he passed an examination by the Board of Inspectors in New York City and received a certificate as Third Assistant Engineer. He at once entered the service of Hargous & Co., as Third Assistant Engineer on one of their steamers plying between New York and Havana, where he continued until the steamer was sold to the United States Government in the early part of 1863. In June, 1863, he entered the service of the Pennsylvania Railroad Company as rodman in the Construction Corps on the Mifflin & Center County Railroad. Within two weeks thereafter he left to volunteer in the army, served throughout the Gettysburg campaign, and was honorably discharged in September, 1863, whereupon he re-entered the railroad service as rodman in the Construction Corps on the Western Pennsylvania Railroad. In August, 1864, he was promoted to be Assistant Engineer of that road, and in May, 1865, to be its Assistant Engineer, Maintenance of Way and Construction. March, 1868, he was transferred to the Columbia & Port Deposit Road as Assistant Engineer and remained there until January, 1869, when he took charge as Assistant Engineer on the Butler Extension. In March, 1869, he returned to the Columbia & Port Deposit Road as Assistant Engineer in charge of that road and the Columbia Bridge. In July, 1870, he was promoted to be Principal Assistant Engineer of the Columbia & Port Deposit Road, serving in that capacity until July 1, 1877, when he was promoted to be Assistant Superintendent of that road. He was promoted on Jan. 1, 1879, to Superintendent of the Lewistown Division; July 1, 1881, to Superintendent Frederick Division; Dec. 8, 1884, to Superintendent Altoona Division; Jan. 1, 1890, to Superintendent Western Pennsylvania Division; Jan. 1, 1891, to Superintendent of Maryland Division of the Philadelphia, Wilmington & Baltimore Railroad, the Baltimore & Potomac Railroad and the Washington Southern Railway. On the 1st of March, 1893, he was promoted to General Superintendent of Transportation, and on Feb. 10, 1897, to General Manager.

ELECTIONS AND APPOINTMENTS.

Atlantic Coast Line.—J. F. Evright, Master Mechanic at Montgomery, Ala., has resigned.

Baltimore & Ohio.—M. L. Byers, heretofore Engineer of Maintenance of Way, has been appointed Assistant to the General Manager. J. B. Dickson, heretofore Assistant Engineer of Maintenance of Way, succeeds Mr. Byers.

Chicago & Eastern Illinois.—See Pere Marquette.

Chicago Great Western.—C. P. Chamberlain, heretofore Assistant Engineer, has been appointed Division Engineer at Des Moines, Iowa, succeeding E. P. Mobley, assigned to other duties. J. H. Burns has been appointed Division Master Mechanic at Dubuque, Iowa, succeeding T. H. Yorke, who becomes Division Master Mechanic at Fort Dodge, succeeding George Gregory, resigned.

Chicago, Milwaukee & St. Paul.—W. E. Powell, General Immigration Agent, with headquarters at Chicago, Ill., has resigned.

Canadian Pacific.—W. R. MacInnes, heretofore Assistant Freight Traffic Manager of the Western Lines, has been appointed Freight Traffic Manager, and F. W. Peters has been appointed to succeed Mr. MacInnes at Winnipeg. B. W. Greer, heretofore Assistant General Freight Agent of the Pacific Division, has been appointed to succeed Mr. Peters as General Freight Agent of the same division, with headquarters at Vancouver, and W. M. Kirkpatrick in turn will succeed Mr. Greer, effective Jan. 1.

Cincinnati, Hamilton & Dayton.—C. M. Overly, Superintendent of Bridges and Buildings at Lima, Ohio, has resigned.

Illinois Central.—J. A. Scott has been appointed Assistant General Passenger Agent, with headquarters at Memphis, Tenn., succeeding W. A. Kellond, resigned.

Louisville & Nashville.—P. O. Stewart, Assistant Auditor of Receipts, with headquarters at Louisville, Ky., has resigned.

A. W. Morris has been elected Second Vice-President, succeeding the late Mr. Edgar.

Marietta, Columbus & Cleveland.—E. E. Finch, General Freight and Passenger Agent, with headquarters at Marietta, Ohio, has resigned, effective Jan. 1.

Michigan Central.—H. Shearer has been appointed Secretary to the General Superintendent.

New York Central & Hudson River.—J. F. Deems, heretofore General Superintendent of the American Locomotive Company, has been appointed General Superintendent of Motive Power of the N. Y. C. & H. R. This is understood to cover not only the New York Central but the Lake Shore, the Lake Erie & Western, the Indiana, Illinois & Iowa and the Pittsburgh and Lake Erie.

Oklahoma Central & St. Louis.—The officers of this company are: President, W. S. McCaull; First Vice-President and General Attorney, J. G. Trimble; Second Vice-President and Treasurer, J. J. Collister, and Secretary, L. Underwood. (See R. R. Construction column, Oct. 24, p. 825.)

Pennsylvania.—On Jan. 1, W. W. Atterbury will succeed J. B. Hutchinson as General Manager, and A. W. Gibbs, heretofore Superintendent of Motive Power of the Philadelphia, Baltimore & Washington at Philadelphia, succeeds Mr. Atterbury as General Superintendent of Motive Power. J. M. Wallis, General Superintendent of the Pennsylvania Railroad Division of the Pennsylvania, has been granted a three months' leave of absence, and G. W. Creighton succeeds Mr. Wallis at Altoona. R. L. O'Donnel, heretofore Superintendent at Pittsburgh, succeeds Mr. Creighton as General Superintendent of the Buffalo & Allegheny Valley Division at Buffalo. S. C. Long succeeds Mr. O'Donnel; C. T. Dabney succeeds Mr. Long as Superintendent at Pittsburgh, and L. T. Ford, heretofore Assistant Engineer, succeeds Mr. Dabney as Superintendent at Oil City. It is reported that the office of Samuel Rea, Fourth Vice-President, will hereafter be in New York city instead of Philadelphia.

Pennsylvania Company.—L. Ohliger has been appointed Superintendent of the Indianapolis Division (Southwest System), with headquarters at Columbus, Ohio, succeeding W. C. Loree, resigned. Otto Schroll succeeds Mr. Ohliger as Superintendent of the Richmond Division (Southwest System), with headquarters at Richmond, Ind.

I. W. Geer, heretofore Engineer of Maintenance of Way (Northwest System), has been appointed Engineer of Maintenance of Way (Southwest System), with headquarters at Pittsburgh, succeeding Mr. Morgan, and H. E. Culbertson, heretofore Assistant Engineer, succeeds Mr. Geer at New Castle.

Pere Marquette.—M. J. Carpenter, heretofore President of the Chicago & Eastern Illinois, has been elected Vice-President and General Manager of the P. M.

Shreveport & Red River Valley.—D. C. Bevard, heretofore Superintendent of the Kansas City Southern, has been appointed Superintendent of the S. & R. R. V., with headquarters at Shreveport, La., succeeding W. H. DeFrance, resigned.

Southern Pacific.—E. L. Swaine has been appointed Assistant Superintendent and is succeeded as Resident Engineer at Los Angeles, Cal., by C. H. Ellison.

Tennessee Central.—C. S. Hayden, heretofore Superintendent of the Southern, has been appointed Superintendent of Construction of the T. C. J. R. Michaels, Superintendent, has resigned.

United R. R. of Yucatan.—The officers of this company are: President, Carlos Peon; Vice-President, E. E. Bates; Secretary and General Manager, N. E. Peon; Chief Engineer, D. J. Linard; General Superintendent, S. G. Ramsey; Auditor, H. O'Connor; Master Mechanic, H. E. Stout, and Purchasing Agents, Thebaud Brothers, of New York City. (See R. R. Construction column.)

Wheeling Terminal.—A. L. Morgan, heretofore Engineer of Maintenance of Way of the Pennsylvania Company (Southwest System), has been appointed Superintendent of the W. T., with headquarters at Wheeling, W. Va., succeeding Otto Schroll. (See Pennsylvania Company).

White Pass & Yukon Route.—The General Offices of this company will, on Jan. 1, be removed from Seattle, Wash., to Vancouver, B. C.

RAILROAD CONSTRUCTION.

ARKANSAS, RED RIVER & PARIS.—It is officially stated that the right of way for the first 32 miles has been secured. Eight miles have been graded. The road will be about 72 miles long. W. A. Carroll, Mena, Ark., is interested.

ATCHISON, TOPEKA & SANTA FE.—An officer writes that the contract for building from Belen to Willard, N. Mex., a distance of 75 miles, was let on Dec. 19. Name of contractor not stated.

AUSTIN & LOCKHART.—The charter for this company was filed at Austin, Texas, on Dec. 13. It proposes to build from Austin to Lockhart, a distance of 35 miles. The incorporators are T. H. Davis, O. L. Bailey, David A. McFall and others, of Austin. This project is in no way connected with the proposed cut-off of the Missouri, Kansas & Texas between Austin, Lockhart and San Marcos.

BASIN & ELLISTON.—Articles of incorporation of this company were filed on Dec. 15 in Montana. It is proposed to build from Basin to Elliston, a distance of about 20 miles. The Montana Reduction Co. has subscribed to two-thirds of the stock.

BATTENKILL.—This company has been incorporated at Greenwich, N. Y., to build from Greenwich to Schuylerville, a distance of seven miles. H. C. Gray, I. C. Blandy and others, of Greenwich, are interested.

BESSEMER & LAKE ERIE.—An officer writes, with regard to press reports of an expenditure of $2,000,000 by this road for improvement of property, that only ordinary improvements will be made, and a few long sidings built.

BLACK DIAMOND.—This company has been incorporated to build from Vincennes, Ind., through Knox, Sullivan, Monroe and other counties to Indianapolis, about 110 miles. The project has no connection with Colonel Boone's North Carolina project. R. G. Haxton, of Worthington, is the principal stockholder.

BURNSVILLE & EASTERN.—Surveys for this new line are reported completed. It is to extend from a point on the West Virginia Central & Pittsburgh to the Little Kanawha, a distance of about 40 miles.

CALIFORNIA SHORT LINE.—This road has been incorporated in New Mexico. Surveys have been made from Alamorgordo to Deming, passing through Lascruces, a distance of 126 miles. It will connect with Chicago, Rock Island & Pacific at Alamogordo, with the Southern Pacific at Deming, and with the Atchison, Topeka & Santa Fe at Lascruces.

CALUMET & SOUTHEASTERN.—Papers for the incorporation of this company were filed at Springfield, Ill., on Dec. 16. It is proposed to build from a point on the Calumet River at Chicago, in a southerly direction to a point on the Ohio River. R. S. Dutton, W. S. Dye and others, all of Chicago, are among the incorporators.

CHICAGO, BURLINGTON & QUINCY.—An officer writes that the contract for a second track between St. Joseph and Amazonia, Mo., nine miles, has been let to MacArthur Bros., of Chicago.

CHICAGO, ROCK ISLAND & PACIFIC.—An officer writes that a line has been located from Dallas to Houston, Texas, a distance of about 230 miles.

CLEVELAND & PITTSBURGH.—Contracts have been let to Drake & Stratton for changing the line from Ravenna to Hudson, Ohio, 12 miles. Grading has already begun. Efforts are still being made to secure the right of way between Rochester, Pa., and Wellsville, Ohio.

DEEPWATER.—Bids for grading, trestle work and masonry on 20 miles of road in Raleigh and Wyoming Counties, W. Va., will be received at the office of the above company at Beckley, W. Va., until Saturday, Jan. 17, 1903. For full particulars see our advertisement columns.

DENVER & RIO GRANDE.—An officer writes that although extensive surveys have been made for a reduction of grade from Palmer Lake to Colorado Springs, and between Palmer Lake and Walsenburg, Colo., it is not likely that work will be authorized for some time.

DES MOINES INTERURBAN (ELECTRIC).—It is reported that this company has recently completed its line from Des Moines, via Altoona, and Mitchelville to Colfax, Iowa, a distance of 20 miles. The army post line and the belt line have also been finished, making a total of 30 miles.

DETROIT & TOLEDO SHORE LINE.—See Railroad News.

DETROIT, MONROE & TOLEDO SHORT LINE.—Articles of incorporation of this company were filed at Lansing, Dec. 11. The Black-Mulkey Electric has been taken over, and the new line will be extended to Detroit. C. A. Black, J. M. Mulkey and others, of Detroit, are interested.

DETROIT SOUTHERN.—Surveys are reported between Napoleon and Toledo, Ohio, 36 miles. No definite plans have been given out.

DIGBY & SYDNEY.—Application will be made at the next session of Parliament to incorporate a company to build from Digby, N. S., to Windsor Junction, Mulgrave and Sydney, Cape Breton.

ENID, SAN DIEGO & PACIFIC.—An officer writes that this road proposes to build from Enid, Okla. T., to San Diego, Cal., approximately 1,000 miles. No track has been laid, and contracts are not let. Edmund Frantz, Enid, is President.

FLORIDA SOUTHEASTERN.—An officer writes that this company proposes to build from Tallahassee, via Perry, Old Town, Lebanon, Brooksville to Tampa, Fla., a distance of about 246 miles. No contracts have been let. J. P. Williams, Savannah, Ga., is President.

GEORGIA, FLORIDA & ALABAMA.—The extension from Grubbs, Ga., to Cuthbert, Ga., 10 miles, is completed. Grading on the extension from Bainbridge, Ga., to Tallahassee, Fla., about 41 miles, is almost completed. Saxon & Hanks are the contractors.

GRAND TRUNK PACIFIC.—It is stated that this company intends to utilize the Midland Division down to the main line of the Grand Trunk either at Port Hope or Belleville, from which there is a double track to Montreal. This means that there will be no line through the Ottawa Valley for some time to come. According to the present route named, the line will pass through Maniwaki, the terminus of the Ottawa, Northern & Western, now controlled by the Canadian Pacific, and which is about 100 miles north of the capital. (Dec. 5, p. 920.)

GREAT NORTHERN OF CANADA.—Surveys are in progress between St. Sauveur, on the Montford & Gatineau, and St. Jerome, a distance of 10 miles. Contracts will shortly be let. A. Doncet, Quebec, is Chief Engineer.

GULF, COLORADO & SANTA FE.—It is reported that this line is to be built from Lometa, Texas, along the San Saba River to Fort McKavett, a distance of about 100 miles. Surveys are now in progress.

HARES VALLEY.—Charter was granted this company on Dec. 16 to build from Mapleton, Huntington County, Pa., to Saltillo, 12 miles. H. Shoemaker, Harrisburg, Pa., is President.

HOUSTON & TEXAS CENTRAL.—The branch from Burnet to Lampasas, Texas, 23 miles, has been opened for business. Surveys are in progress on extensive grade reductions north of Dallas, Texas. John P. Hughes is the contractor.

INTERNATIONAL & GREAT NORTHERN.—This road has filed notice of application at the next session of the Legislature for a purchase bill, with permission to purchase and absorb the charter rights of the Houston, Beaumont & New Orleans, thereby giving it power to issue bonds for new construction. It is reported that surveys have already been made for building a line to New Orleans, paralleling the Southern Pacific.

INTERSTATE (ELECTRIC).—Chartered in Camden, N. J., with $10,000,000 capital, to control electric lines in Pennsylvania, New Jersey, Delaware and New York. The incorporators are F. B. Hansell, W. F. Eidell and others, of Camden.

ITHACA-AUBURN (ELECTRIC).—Press reports state that work will begin on this road on Jan. 1. The preliminary surveys are reported completed. The road is to be about 37 miles long and will run between the above named points.

KISKIMINITAS CONNECTING.—This company was chartered in Pennsylvania, Dec. 18, to build from Freeport, Armstrong County, Pa., to Kelly, Pa., six miles. S. H. Hicks, Bryn Athyn, Pa., is President.

KNOXVILLE, LAFOLLETTE & JELLICO.—The contract for building the Oliver Springs branch of this road has been let to the Callahan Construction Company. The branch will leave the main line at Dosset, Tenn., and go to Oliver Springs, and thence up the valley for several miles. It will parallel the Southern as far as Oliver Springs.

LOUISVILLE & ATLANTIC.—The extension of this road from Beattyville to Miller's Creek, Ky., a distance of 27 miles, has been completed, and the road is now opened for traffic.

LOUISVILLE & NASHVILLE.—Surveys are reported at Middlesboro, Ky., for a projected road from Pineville to Jellico.

MANITOBA & NORTHWESTERN.—Application will be made at the next session of Parliament to incorporate a company to build from Prince Albert northwesterly to a point on the Saskatchewan River near Battleford, and thence to a point on the Calgary & Edmonton near Wetaskiwin.

MISSISSIPPI & SOUTHWESTERN.—Charter has been granted this company in Mississippi to build from Webb, Miss., to Helena, Ark., via Glendale. The distance is about 45 miles.

MOHAWK & HUDSON.—This company has been formed in New York to build from Oneonta to New Berlin, N. Y., a distance of 33 miles. F. F. Colver, G. Whittlesey and L. R. Morris are directors.

MORELIA & TACAMBARO (MEXICO).—It is officially stated that this road will be built between the following points: From Irapuato on the Mexican Central to Morelia, capital of the State of Michoacan, and through Tacambaro to Ario, a distance of about 225 miles. Contracts not yet let.

NEPIGON.—It is reported that contracts for grading from Nepigon, Ont., to Lake Nepigon, a distance of 40 miles, will shortly be let. P. B. Weidener, of Detroit, Mich., is said to be interested.

NEW ORLEANS & NORTHWESTERN.—An extension from Bastrop, La., to White, 17 miles, has been finished. Grading is in progress on an extension to Eldorado, Ark., a distance of 63 miles.

NORFOLK & WESTERN.—The following extensions have been made on this line during 1902: Speedwell extension, 6½ miles; Crane Creek branch, eight miles; Briar Mountain, two miles; Washington Mills extension, 5½ miles; Chestnut Creek branch, three miles; Tug Fork branch, six miles; additional mileage in Virginia, 14½ miles; additional mileage in West Virginia, 18 miles. New road under construction, Naugatuck to Cassville, W. Va., 33½ miles; Cassville to Kenova, 25½ miles. A line from Cephas to Widemouth, 60 miles, is under survey.

PENNSYLVANIA.—Contract for double tracking the West Pennsylvania between Blairsville and Bolivar, Pa., a distance of seven miles, has been awarded to Gonder & Broumback. The above parties also have the contract for elevating the tracks through Chester, Pa.

President Cassatt has approved the plans for the new yard at Fairview, on the Northern Central. Contractor Kerbaugh has already commenced work. The yard will have a capacity of 3,000 cars, and will be 2½ miles wide.

PITTSBURGH & LAKE ERIE.—Work on the double-tracking of the Monongahela Division of this road is reported in progress. The 2½ mile stretch between Coursin and Lovedale is almost completed.

REDSTONE CENTRAL.—This company was granted a charter in Pennsylvania on Dec. 18 to build from Dearth, Pa., to a point on the Monongahela River, near Redstone Creek. L. W. Fogg, Uniontown, Pa., is President. F. Emory, L. W. Fogg and others, all of Uniontown, are interested.

SEABOARD AIR LINE.—Contract for building the six miles of road between Raglan and Coal City, Ala., has been awarded to the Donelson Construction Co., Birmingham.

SHREVEPORT & RED RIVER VALLEY.—An extension of this road from Alexandria to Mansura, a distance of 30 miles, is reported completed. An extension from Mansura to Water Valley, La., 20 miles, is in progress. Epple & Hayes, of Shreveport, are the contractors.

SOUTH & WESTERN.—Press reports state that work will be resumed on this road between Johnson City and Kingsport, Tenn. Ninety per cent. of the road is graded, but work has been at a standstill for several months. Geo. L. Carter, Bristol, Tenn., is President.

SOUTHERN INDIANA.—Surveys are reported completed for the projected extension of this road from Terre Haute to Evansville, Ind. The new line will pass through the rich coal region near Oakland City, and is several miles shorter than the original route. The Southern Indiana now runs from Terre Haute to Westport, Ind., about 148 miles. John R. Walsh is President.

TENNESSEE CENTRAL.—Rights of way are reported secured between Clarksville and Hopkinsville. The following contractors are at work on their respective sections: Robert Russell & Co., at Hopkinsville; Garner & Co., M. J. Price, Kestler & Oliver at the Clarksville end. R. E. Harwood, Nashville, Tenn., is Chief Engineer.

TEXAS & PACIFIC.—Grading is reported as completed on the 70 mile extension from Natchitoches, La., to Shreveport. Track is laid for about 10 miles. The Grigsby Construction Co. are contractors.

TRINITY & BRAZOS VALLEY.—Contracts will be let in a few days for building a road from Hillsboro to Mexia, a distance of 50 miles. B. Thompson, Hillsboro, is Chief Engineer.

VELASCO, BRAZOS & NORTHERN.—At a recent meeting of the directors of this company provisions were made for an extension of the line from Anchor to Arcola, Texas, a distance of about 18 miles. An extension north from Sugarland to Dallas, a distance of about 250 miles, is projected.

WESTERN MARYLAND.—Contract for the tidewater extension of this road in Baltimore has been let to the Degnan, McLean Contracting Co., of New York. It is to be 6⅔ miles long, from a point south of the Wallerook station down the valley, to Fort Covington in South Baltimore. A great part of the work will be sublet.

WINDSOR LOCKS.—Articles for the incorporation of this company have been filed in Connecticut. The proposed route is from East Granby on the Tariffville extension of the Central New England, to Windsor Locks, a distance of about five miles. C. E. Thomas, A. B. Perkins and others, of Hartford, are among the incorporators.

GENERAL RAILROAD NEWS.

New Incorporations, Surveys, Etc.

ADIRONDACK.—This road has been merged with the Delaware & Hudson and will be operated as a part of the Saratoga Division. It runs from Saratoga Springs to North Creek, N. Y., 57 miles, and will increase the total mileage of the Delaware & Hudson to 717 miles.

CACHE VALLEY.—This road was formerly known as the Black & Cache River.

CHESAPEAKE WESTERN.—It is reported that 30,000 acres of land in Bath and Highland Counties, Va., and in Pocahontas County, W. Va., have been bought by this road. Surveys were made by the Chesapeake Western some time ago from a point in Rockingham County to Durbin, W. Va. The area surveyed is practically all included in the recent purchase.

CINCINNATI, HAMILTON & INDIANAPOLIS.—Holders of the first mortgage 7 per cent. bonds of this road, maturing on Jan. 1, are notified that the principal, and coupons due on their bonds, will be paid by Vermilye & Co., on and after Jan. 2. The first mortgage bonds of the Cincinnati, Indianapolis & Western, due Jan. 1, 1953, have been purchased by Vermilye & Co. from the Cincinnati, Hamilton & Dayton. These bonds are issued against the 7 per cent. bonds, and the holders of the maturing bonds have the privilege of exchanging their old holdings for the new issue, plus $45 in cash per bond.

DETROIT & TOLEDO SHORE LINE.—This road has been sold to the Grand Trunk and the Toledo, St. Louis & Western. W. B. Strong & Co., the original contractors, will complete the road from Trenton to Delray, near Detroit, a distance of 15 miles.

ELGIN & HAVELOCK.—This road has been sold to the Gilson Syndicate of Halifax, N. S. It runs from Havelock, Kings County, to Elgin, Albert County, a distance of 27 miles. John F. Stairs and B. F. Pearson are members of the syndicate.

KEOKUK & WESTERN (CHICAGO, BURLINGTON & QUINCY).—It is reported that this company has purchased the old roadbed of the Des Moines & Chillicothe, 30 miles long, extending from Trenton, Mo., to Chillicothe. No track had ever been laid on the Chillicothe route.

LOUISVILLE & NASHVILLE TERMINAL.—This company has filed a mortgage with the Manhattan Trust Co., of New York, for $3,000,000. The bonds are guaranteed by the Louisville & Nashville and will be divided as follows: A portion of these will be used to retire the issue outstanding, and $500,000 will be reserved for future additions and improvements.

NEW YORK CENTRAL.—J. P. Morgan & Co. are refunding the outstanding issues of the old 7 per cent. and 6 per cent. bonds of this road due on Jan. 1, 1903. These bonds are to be paid off on Jan. 1, or converted into 3½ per cent. new bonds. A fair percentage of these bonds are owned by London investors.

PITTSBURGH, LISBON & WESTERN.—Consolidation between this road, the Salem Terminal and the Shenango & Beaver Valley has been effected. The deeds for transfer of the property have been filed and the new company will be known as the Pittsburgh, Lisbon & Western.

SOUTHERN INDIANA INTERURBAN.—This company has recently filed a deed with the American Trust & Savings Bank of Chicago to issue first mortgage 5 per cent. bonds, amounting to $350,000. Two-thirds of these will be sold and the proceeds used on necessary construction, extension and enlargement of the system. The remaining one-third will be used for future improvements, franchises and rights of way.

SOUTHERN PACIFIC.—Announcement is made that beginning with Sunday, Jan. 4, all Southern Pacific trains will enter and leave the Union station in New Orleans, jointly with the Illinois Central. As previously announced the Southern Pacific trains will be ferried across the river at Avondale, 11 miles above the city, and will run into the city via Harahan. This will save about 35 minutes in time, and will require a change of schedules to meet the new conditions. At present trains of the Southern Pacific arrive at and depart from Algiers, across the river from New Orleans.

SYRACUSE RAPID TRANSIT.—The sale of the Oswego Traction property to this company has been completed. W. P. Gannon is President, and E. G. Connette manager of the Syracuse Rapid Transit Co. No statement of plans has been given out.

UNITED RAILROADS OF YUCATAN.—This company has recently been formed by the consolidation of the Merida, Progreso & Izamal; the Merida & Valladolid, and the Peninsular Company. For particulars, see Oct. 10, p. 774; for election of officers, see Elections and Appointments.